The SCOTS ARITHMETICIAN,

Or

ARITHMETICK

In all its Parts, viz.

Arithmetick { Vulgar or Decimal. / Algebraical or Analitical. / Sexagenary or Circular. / Logarithmical or Artificial. / Instrumental or Mchanical. } *In Integers and Fractions.*

To which their is added many neceſſary Tables and Cuts, uſeful to every one, both Young and Old, being more eaſy and compendious then any heretofore.

Note, that this Book exceeds the price of others of its magnitude, by reaſon of the difficulty of its Printing, ſmalneſs of the Print, the Cuts and fewneſs of the number Printed. Expect the reſt of the Books, mentioned in this Title Page with the firſt occaſion.

By James Paterſon *Mathematician.*

EDINBURGH,

Printed by *Joſhua van Solingen* and *John Colmar*, and are to be Sold by the Author at *Edinburgh*, by *James Brown* at *Glaſgow*, and by *Andrew Man* at *Antrim* in *Ireland*, *Anno* 1685.

244 Paterson (James) The Scots Arithmetician, *with verses, neat*, 8*s*. - 12mo. *Edinburgh*. 1685

"This book exceeds the price of others of its magnitude, by reason of the difficulty of its printing, smallness of the print, the cuts, and fewness of the number printed."—*Extract from the Title.*

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BRITISH MUSEUM

Drummond

To the Right Honourable,

Sir GEORGE DRUMMOND
Of *Milnnab*, Lord Proviſt,

Thomas Robertſon, Thomas Hamel-town, Alexander Brand *and* David Spence, *Bailzies.* Charles Mur-ray *Dean of Gild*, George Drum-mond *Theſaurer*, William Watſon *Deacon Conveener*, *and Remanent Members of the Honourable Council of the Ancient*, *and Famous City of* Edinburgh.

RIGHT HONOURABLE,

I Being bound in duety to preſent unto you this ſmall Treatiſe of *Arithme-tick*, for the many and great favours *Your Honours* have Conferred upon me; As not only in commending my *Almanacks* in the Feaſts, (but after

ſtrict inquiry made therein) have paſſed an Act diſcharging the Publiſhing, or Printing of any other; as alſo for Counterfiting of the ſame within the Limits of this Honourable *City* in time coming, which I hope will not only be profitable to this *City*, but alſo to the whole Kingdom: Conſidering the great loſs that hath followed upon the Errors of other *Almanacks* to many parts of this Kingdom, whoſe Fairs depend upon theſe Feaſts. This and many other profitable Acts hath *Your Honours* paſt for the encouraging of Vertue, and puniſhing of Vice within this *City*. And now right Honourable, though I want the means to publiſh ſo good a Work as you deſerve; yet I want not the minde and inclination to proceed ſo far therein, to ſhow my reſpects and obligation to you, but perhaps it may ſeem unneceſſary in this age, to publiſh any thing to this purpoſe, ſeeing there are ſo many learned Engliſh and other Authors, who have written largely upon this Subject: Yet, if *Your*

Honours will be pleased to cast a favourable eye upon it. I doubt not, but it will be of great use to all those who have any Fairs in this Kingdom, seeing the most part of the measures made use of in it are *Scots* measures, which are not used in the *English*; Accept therefore in good part this Testimoney of my humble affection to your Honours, and love for the welfare of this Honourable *City*. So craving pardon for my boldness, I rest

Your Honours most Humble,

and Obedient Servant

JAMES PATERSON.

To the READER.

COURTEOUS READER.

I Here present thee with this small Tractate of Arithmetick which (as it hath been my study in my youth) I hope it may be profitable to those of younger years, and not unprofitable to those of riper age, the most part of the measures made use of, being Scots measures and weights, and the fundation, thereof being laid down in the first *Chapter*, will render it more useful to those what have any affairs in this Kingdom, then any heretofore set forth: So leaving it to thy Candid Censur and aprobation. I Rest

Thy Friend to serve thee

JA: PATERSON

Errata.

Page 6. lin 13. for 1396. read 1369. pag. 8. line 8. for 85. read 21,1'4. pag 9. line 5 for six hides, read ten. page 11. margin, for Eu. ax 3. read only ax 11. page 16 marg read likewise ax 11. page 21. last line except two, for to hand, read to the right hand. page 24. line 11. for left, read right. last line except two for multipliers, read multiplier. page 26. line 4. for 20. 8. read 8'20. page 27. line 20. for so, read and so. page 28 last line except two, for 0. read 4. page. 34. line 15. for (08. read (00. page 37. line 12 for 936. read 636. line 27. for Bule, read Rule. page 40. line 14. for 4 Rule, read 5 Rule. margin for def. 44. read def. 19. page 41. margin, for def. 44. read def. 19. page 45. margin, for def 44. read def. 19. page 48. line

Errata.

line 20. for by pound, read 67 pound. page 49 in the head, for propoſition read proportion. page 50. in margin, for Ax. 13. read Ax. 10. page 53. in the head, for popoſition, read proportion, line 9. for 1'5. read 1, 1'5. page 55. line 14. for Compponned, read Compouded. page 64. laſt line except two, for foot, read foot)

Ane Acroſtick on my worthy friend *James Paterſon* Mathematician, Author of this Book.

I n this brave Book, we ſee without compare;
A rithmetick into all it's part's ſo rare.
M uch underſtanding in it we may find,
E ven in this book for to content our mind:
S o other Pamphlets let us caſt behind.

P leaſure ye'l find, if ye therein will look
A nd well obſerve the Secrets of this Book,
T o every on that doeth arte deſire,
E nough he ſhows to make each one admire;
R emembering ſtill for to uſe his talent:
S o to do good his heart is fully bent.
O p'ning all the miſteries of this Art;
N othing he hide's but open's each dark part.

M akes all moſt plain to thoſe of younger years,
A nd to the ag'd no error their apeares
T outching Arithmetick, it ſhines here moſt bright,
H ere hiden queſtions are brought forth to light,
E ven of all Arts it is the firſt foundation
M uch are wrought by it, to great admiration,
A lſo his rules in Rym he doth covert
T ogether with its ſenſe he doth Impart,
I n a ſhort methode lets us clearly ſee,
C auſing it in each part for to agree.
I nto this Book rare Tables find we may
A s ye may ſee, practiſe it well, I ſay,
N othing it want's that's uſeful any way,

By J. H. a Lover of the Mathematicks.

De-

Definitions of the Terms, used in Vulgar *Arithmetick.*

1. ARithmetick, is the Science or Art of Numbering with all its properties and apurtunances, and is either Simple or Compound.

2. Arithmetick simple, is that which dealeth with whole numbers only, or such as are taken as whole numbers.

3. Arithmetick Compound, is that which is mixed with some Geometrical conclusion, or where an unite is divisible into a Fraction.

4. Vulgar or Decimal Arithmetick, is that which is commonly used and Expressed by figures and places which increase towards the left hand Decimally, or where each place towards the Left hand increaseth the value of any figure in a decuple proportion, *as the figure* 3. *in the first place is* 3. *in the second* 30. *in the third* 300, &c.

* *Eu.* 1. *Def.* 7. 5. An * unite, is that whereby every thing is called one, being of it self no number; but yet can measure every Integer or whole number.

* *Eu.* 2. *Def.* 7. 6. A * Number, is a multitude composed of units which contains so many times any thing as their are units therein, and is either cardinal or ordinal, being compendiously expressed by figures.

7. Figures in Arithmetick are certain Charecters shewing the value of an Integer or Fraction, being in number ten, *viz.* 1. one, 2. two, 3. three, 4. four. 5. five,

5. five, 6. six, 7. seaven, 8. eight, 9. nine, with the Cipher (o.). There are other 7 used in ordinall numbers, *viz.* I. one, V. five, X. ten, L. fifty, C. an hundred, D. five hundred, M. a thousand, (being all Letters) where that of the Lesser is alwaves placed to the right hand of the greater increasing; But if placed to the left hand, it deminisheth the greater, according to the units contained in the lesser.

8. A Cipher (o) is a Charecter set only to fill up a place, which towards the left hand of an Integer, or to the right hand of a Decimall Fraction is of little or no use.

8. A digit is any figure set by it self, or understood so to be;

10. A Fraction is a part or parts of an unit, being Expressed by Numerator and Denominator, *as* 1'2 *one two part or an half*, 3'5. *three five parts*, &c.

11. The Numerator of a Fraction, is that Part thereof which sheweth the value thereof in any Denomination, as 1. in 1'2, and 3 in 3'5, &c.

12. The Denominator of a Fraction, is that part thereof, which sheweth the Denomination thereof, or the parts in which the unit is divided; where it is commonly placed after the Numerator, except in known Denominations, as in Decimal Fractions, or in shillings, in regard of pounds where the Denominator 20. is understood.

13. A Decimal Fraction, is that whose Denominator increaseth in a decuple proportion, that is by tens in a Geometrical progresion, as 2'10, or '2, 43'100 or '43, &c.

14. A Fraction of a Fraction, is the part or parts of a Fraction, as a penny is the 1'12, of 1'20. of a pound.

15. Abreviation of Fractions, is the shortning or reducing of them to their least tearms for the more easy working therewith, as 6'12 is 1'2 being a breviated.

16. Fractions are said to be in one Denomination, when they have one common Denominator, as 1'20 and 3'20 or the like..

17. A Fraction is said to be reduced to a given Denomination, when retaining the same value, the Numerator thereof answereth to the given Denominator as 1'2. reduced to a Decimal Fraction is 5' 10. or '5.

18. An Improper Fraction is that whose numerator exceeds its Denominator, as 36'4, or 58'25. or the like.

19. An Integer is said to be placed Fraction when there is an unite placed for its denominator, as 34'1, &c.

20. A Fraction is said to be taken as a Integer when Compared to another, its Denominator is understood by some known name, as if it were an Integer, as in 12'20, of a pound, the Denominator 20. is understood by the known name of shillings.

21. A Place in Arithmetick is the position of any figure, in regard of another for the augumenting or diminishing the value thereof, as in the 4. definition.

22. A degree in Arithmetick is the Collection of three places under one principal name. (the first place of each degree towards the right hand being the unites thereof, the second the tens and the third the hundreds thereof) as 324. is named three hundred and twenty four.

23. A Double degree is the collection of two degrees under one principal name (the first degree of each double degree caries the principal name of the double degree, and the second to the left hand are the thousands thereof) the first double degree is unites, the second millions, the third millions of million, &c. naming the millions the oftener, but I think it more fit for to name the third double degree Billions, the fourth Trillions, the fifth Quadrillion, the sixth Quintillions, the seventh Sextillions. &c.

24. An Integer or Fraction is said to be numbred, when the true value thereof is expressed according to the places and figures placed therein, as 34. thirty four.

25. In-

25. Integers or Fractions are said to be added together when the tottall doth contain so many unites in value, as there are unites contained in the value of those added, as $3 + 4 = 7$.

26. The tottall, agregate or Gross summe of two or more Integers or Fractions, is the summ produced by adding the said Integers or Fractions together as 7 is the tottall of $3 + 4$.

27. An Integer or Fraction is said to be Substracted from an other when the Substracter is taken from the Substrahend, so that there remaineth either an Integer, Fraction, or nothing being equall to the difference of the Substrahend and Substracter, as $7 - 3 = 4$.

28. Integers or Fractions are said to be substracted from other, when the tottall of the substracters is taken from the tottall of the substrahends, as 3, 4 and 5. is said to be substracted from 5, 6. and 7. when 12 the tottal of the substracters is taken from 18. the tottall of the substrahends, the remainers being 6.

29. The Substracter, is that Integer or Fraction, which is to be taken from another as in $7 - 3 = 4$. the Substracter is 3.

30. The Substrahend, is that Integer or Fraction, from which the Substracter is to be taken as in $7 - 3 = 4$. the Substrahend is 7.

31. The remainer is that, which remaineth the Substracter being taken from the Substrahend, as in $7 - 3 = 4$ the remainer is 4.

32. A Number is said to multiplie another when the product compound thereof contains the multiplier so many times as there are unites in the multiplicand, as $3 \times 4 = 12$.

33. A Fraction is said to multiplie an Integer or Fraction, when the product is the same part or parts of the multiplicand that the multiplier is of an unite. as $12 \times 1'2 = 6$.

34. Integers or Fractsons are said mutualy to multiplie one another, when the first is multiplied by the second

ſecond, and the product theteof by the third, and ſ
Infinitly each product by that which followeth, as 2 x
=4 x 3=12x6=72.

35. The multiplier or multiplicator is that Intege
or fraction which multiplieth the other, as in 3x4=
12. and the multiplier is 4.

36. The multiplicand is that Integer or Fractio
which is to be multiplied by the multiplier, as i
3 x 4=12 the multiplicand is 3.

37. The Product is that Integer or Fraction which i
produced of the multiplication of the multiplicand b
the multiplier as in 3 x 4=12. the product is 12.

38. A number is ſaid to be meaſured or divided b
another number, the greater by the leſſer, when th
dividend containeth the diviſor ſo many times as ther
are unites in the quotient as 3) 12 (4.

39. A Fraction is ſaid to meaſure or divide anothe
Fraction or Integer, when the dividend is the ſame par
or parts of the quotient, that the diviſor is of an unit
as 1'2) 6 (12,

40. Integers or Fractions are ſaid to be divided b
other Integers or Fractions, when the tottall of the divi-
dends is divided by the tottal of the diviſors, as 3,
and 5. is ſaid to be divided by 2 and 4. when 12. the tot
tal of the dividends is divided by 6. the tottall of the di-
viſors, the quotient being 2.

41. The Diviſor, is that Integer or Fraction b
which the dividend is to be divided, as in 3) 12 (4 the
diviſor in 3.

42. The Dividend, is the Integer or Fraction given
to be divided by the diviſor, or as in 3) 12 (4. the divi-
dend is 12.

53. The Quotient is that Integer or Fraction which
is produced of the diviſion of the dividend by the divi-
ſor, as in 3) 12 (4 the quotient is 4.

44. The Reſolvends are the ſeveral parts of the di-
vidend, out of which the product of each figure in the
quotient with the Diviſor is to be taken.

Axioms or common Sentances.

1. IF as many numbers as you pleaſe be added together, the units contained in the ſumme is uall to the unites contained in the numbers added.

2. The ſum of any two things exceed the difference by the double of the leaſt.

3. If halt the ſumme and half the difference of any o things be added together, their ſum ſhall be equall the greater.

4. The whole is equall to all its parts taken toge-er.

5. If to equall things unequall things be added, the xceſs or difference of the whole ſhall be equal to the Ex-ſs, or difference of the things added.

6. The ſumme of the ſubſtracter and remainer is e-uall to the ſubſtrahend.

7. If a leſſer thing be taken from a greater, the re-mainer ſhall be of that denomination of which the greater is of.

8. If half the difference of any two things be taken from half the ſum, the remainer ſhall be equall to the leſſer.

9. If from unequal things equall things be taken, the Exceſs or difference of the remainers ſhall be equall or the ſame with exceſs or difference of the wholes.

10. By Inverting the order in Multiplication doth not alter the laſt product.

11. If the nines be caſt out of as many Integers or decimal Fractions as you pleaſe, and the ſame operation be performed with the remainers as with thoſe given, and that the nines likewiſe be caſt out of that which is produced of both; the remainers of the one ſhall be equall to the remainers of the other.

12. An unite doth neither multiplie nor divide.

13. Every

13. Every thing measureth all that is compoun thereof.

14. If by equall things or one and the same thing equall things be multiplied the products shall be equa

15. Every mean is greater then the least of the E treams, and less then the greatest.

16. If as many multiplicands as you please, be mu tiplied by any number of multipliers, the summe o their products is equall to the product of their summe

17. If any Integer or Fraction be multiplied by an part of another, the product shall be the same, as the other were multiplied by the same part of th first.

18. If by equall things, equall things be divided the quotients and remainers shall be equall.

19. The sides or Roots of equall squares cubes, &c are equall one to another.

20 If the remainers of any division be added to th product of the divisor and quotient their summe sha be equal to the dividend.

21. If four Integers or Fractions be proportiona the fourth shall be as multiplex, or the same parts of th third that the second is of the first, or of the secon that the third is of the first.

22 If four Integers or Fractions be proportional they shall likewise be proportional alternatly, inver sly, by composition, division and conversion.

Definitions of certain Symbols, or Charecters used in Vulgar *Arithmetick.*

Equal.
More, or to be added to.
Less by, or it sheweth that the second is to be substracted from the first.
The difference of any two things.
Multiplied by.
2(4. Showes that 12. being divided by 3. the quotient is 4.
Proportion or the Golden Rule.
Stones in Weight.
Pounds of weight or money.
Shillings.
Pennies, or a degree in measure, a day in time, &c.
Leagues.
Miles, Mutchkins, &c.
. Ounces.
Drops.
Grains.
. Ounces
. Drams. } In Apothecaries Weight.
Scruples
Ten and ten.
or: 5. Five tenths.
r 1:2 or 1'2. one half.
4 foot. three foot and one fourth part of a foot.
a Pace in long measure, a Peck in dry measure, &c.
A foot, Fatham, fall, &c. according to the measure.
Inches.
Ells.
Chalders, Chopins, &c.
Bolls.
Firlets

To

Advertiſements.

1. ADVERTISEMENT, *that* Mr. Iohn Sare *Oc*
liſt mentioned in my Almanack 1685. *hath within t*
Kingdom cured very many of ſeveral Diſeaſes, and eſp
cially of the eyes, wherein he knows above 113. *cure*
ble diſtempers, and will tell them whether cureable or n
if cureable he cures them without pain, ſo that there
not one amongſt 40. *cryes oh! in the operation: in ſho*
he hath couched near 1000. *eyes within theſe* 24. *year*
and within theſe two years laſt paſt hath cured near 10
within this Kingdom, and by the bleſſing of God reſtor
them to their ſight again, although one was aged 82 *year*
and many that he couched 14 *or* 15 *years ago, rema*
with good ſight, he hath moſt excellent and powerful R
medies for ſtrengthning and increaſing of weak & dec
ed ſight, and preſerving the ſame both in young and o
He couched and cured at Dundee, John Fleming, Jan
Rodger, John Mudie, Janet Robertſon, *a wido*
and Margaret Cook. *At* St. Johnſtoun, Beſſy Angus, *w*
was blind 7. *years, and aged* 63. *years, and* Janet
ton. *At* Stirling *he cut and cured the Cancers of* An
bel Wilſon, Daniel Wright, *and many others in ſeve*
parts of the Kingdom, as at Edinburgh, Aberdeen,
nerneſs, &c. *he is now at Dalkieth.*

Second ADVERTISEMENT, *that* James Cathc
Student in Aſtrology and Phyſick, reſolveth all lawful Q
ſtions in Aſtrology, with great certainty, if ſeriouſly
poſed; he hath ſeldom, or never fail to give any perſon
eaſed a true account of the nature of the diſeaſe afflict
and part afflicted, and if cureable or not; and of
you may have good and cheap Medicines with direct
to uſe them. He is to be found at his own dwelling H
at the Northſide of the Cannongate, *a little beneath*
Craigwel.

3. ADVERTISEMENT, *thoſe who deſire any Ma*
matical Inſtruments, as Croſs-ſtaffs, Quadrants, Sc
Spiral lines, Dials, Uncels for weighing money. or the
portable Ink, Sea Compaſſes made or dreſt, or any Ma
macal or Sea-books. Edinburgh 13. May, 1685. *a*
head of the Cowgate, *in the ſign of the Croſs-ſtaff*
Quadrant. JA. PATERSON

I. PART Primative.

CHAP. I. *Numeration;*

Numeration is that part of *Arithmetick*, whereby we express and read the true value of any Integer or Fraction.

The 1. Rule of Integers.

TO number well reckon by threes,
The places backwards in degrees.
As in the Table ye may finde,
Each places name; which keep in minde;
And then begin at the first place
To read forwards three in each space,
The figure first, the place then name,
The hundreths keepeth still the same;
For tenths name ty above nineteen,
The rest except twelve and eleven.
Then after units name put ye,
Which figures name will only be.
Then after name the principal,
Millions or thousands, as they fall.

The sence:

TO number well, first reckon the places backwards by threes, calling each three a degree, and each two degrees a double degree; as you may see in the Table, where the principal name of the first double degree is units of the second millions, of the third, millions of millions; and so infinitly, naming the millions the oftener, the first degree of each double de-

gree, (reckoning back) being called the units thereo
and the second the thousands thereof.

Then to know the name of each place (and especia
ly of the first that you must begin at) to read forward
Note, that if the e be just degrees that you must begi
at the hundreds; if one place over, you must begin
the units of the nixt degree, if there be two place
over, you must begin at the tenths thereof, and so g
forward; expressing still, first the figure and then th
place in each degree. For hundreds the name of th
place forwards is also hundreds, for tens name the plac
(ty) forwards if it be above nineteen; that is to say
if the figure be a number: but if it be an unite, pu
teen after the units name following; except twelve o
eleven; that is to say, when the units following is
or 2. For the units name only the figure. Then afte
name the principal place of each degree as they fall b
course.

The use of the Table.

* Def. 7. *TO number any Integer in the following Table, nam
first the * figure and then the place as in the fo
thereof; except when you meet with any of the mark
and then must the two figures including the mark be con
poned under the name, which it directeth to in the mar
By observing the foregoing rule and table thereto belon
ing you may set down likewise any number which
written at length or dited by an other.*

Example.

SUppose it be required to set down Arithmetically
order, three hundred and fifty four thousand, s
hundred and seventy two, set it down thus 354672.

Th

The Table of Numeration.

| | | |

The 2. Rule of Fractions.

For Fractions, first name Numerator;
Nixt after, name Denommator.

The sence.

TO number in fractions, first name the Numerators of the fraction given to be numbered and then name the Denominator thereof, as before is taught in the rule of Integers.

1. *Example.* 2. *Example.*

N. 1 / D. 2. one two part — N. 2 / D. 3 two third parts.

3. *Example.*

N. 356 three hundred and fifty six,
D. 587 five hundred and eighty seven parts.

But when you are to make any Arithmetical operation theirwith, they are more conveniently placed thus, 1 : 2. 2 : 3. 356 : 587 &c.

N. D. N. D. N. D.

In known Denominations the Denominators are for the most part understood, either by the number of places in the Numerator, as in decimal fractions, or Symbols, as S for shillings, d for pennies, or the like.

The Denominations of decimal fractions are expressed by an unite, and as many Ciphers as the Numerator hath places, as : 6 is expressed thus $\frac{6}{10}$ and : 25 thus $\frac{25}{100}$ likewise : 005 thus $\frac{005}{1000}$ &c. so that they increase in a decuple proportion.

The

he foundations of the moſt common mets and meaſures of Scotland *with their Denominators.*

1. Of value.

THe value of money is either Intrinſick, or Extrinſick.

The Intrinſick value is reckoned according to the nneſs and weight of the mettal. The finneſs of the ettal is reckoned by Carrects, which is no certain eight, but the 24 part of any quantity or weight; ch carrect being divided into 4 grains: ſo that gold ſilver is ſaid to be 22. Carrects fine, when it hath 22. arrects of pure gold or ſilver, and 2 Carrects of Allay. he proportion of values differs according to the aundance or ſcarceneſs of any mettal, as at this time e reckon the proportion of gold to ſilver to be as 12 o 1. in value, which before was greater.

The Extrinſick value is the Coyn or outward Chaacter ſet upon any piece of money.

The account of money is kept in pounds, ſhillings nd pennies, their Denominators being as followeth,

S. d.

pound 20: 12. Denominators.

Whence you may ſee that 12 is the Denominator of ennies in regard of ſhillings, and 20 the Denominaor of ſhillings in regard of pounds; ſo that pennies is he fraction of a fraction and ſo of any other.

2. *Quantity.*

THe meaſures for quantity is divided into three *ſpecies*, *viz.* Lineal, Superficial and ſolid meaſures.

Lineal meaſures are founded from a barley Corn lying in length without taile, called a lineal grain, their Denominators being as followeth,

d. L. M. paces foot inches grains

Cir. earth. 360. 20. 3. 1184. 5. 12. 3. Deno.

8. Inches make a Glassen-wright foot.

There are several other measures for length used by the ancients, as these following,

Cubits spans palms inches

Fathom 4 : 2 : 3 : 3 Denominators

There are also other lineal measures used as these following,

* Ells Inches.

Fall 6. 37. Denominators.

* *The standard Ell of Edinb.*

2. Superficial measures are founded from the foresaid lineal measures squared, as these following,

roods * falls ells inches.

Acre 4 : 40 : 36 1396. Denominators.

* *A square-fall is equal to a slater Rood of work.*

4. Acres are counted for a Ministers Gleib, 6. Acres arrable Land an Husband Land, 13 Acres an oxen-gate 4. Oxen-gate a pound Land.

A quarter Land in *Ireland* is as much Land as a six Horse plough will plew in plewing time, the Denominators are

Q. horsgang feet.

Town Land 4 6 4. Denominators.

There are other square measures used, as these following,

foot Inches

A Rood of Land within burgh of old 20 : 144 D

64. Inches make a Glassen-wrights square foot.

3. Solid measures are founded from the foresaid lineal measures Cubed, as these following

Ells Inches Q.

Rood 36 : 50653 64 Denominators.

1728 Inches make a foot for measuring Timber Stone, &c.

3. *Of Weight.*

THe measures for weight are founded from a grain of wheat taken out the midle of an eare of wheat called a grain; their Denominators being as follows

* Stone

lb. Ou dr. grains.

*Stone 16 : 16 : 16 : 36. Denominators. * The standard stone of Lanerk.

12 Ounces make a pound troy-weight, which is 12 unces 3 drop, 21 grains Scots weight.

600 lb. is esteemed a tun weight of light goods, which is the common fraighting of all Merchandice betwixt this Country and *England*, *France* or *Spain*.

40. Stone is esteemed a sack of goods which is the common fraighting of all Merchandice from this Country to the *Low countryes*.

80. Stone is esteemed a serplith of goods, which is the common fraighting of all Merchandice betwixt this Country and the Eastern Countryes.

120 Stone are esteemed a last of goods.

126 Stone make a fider of Lead.

There are also other weights used by Apothecaries, as these following,

℥ ʒ ℈ gr.

A pound 16 : 8 : 3 : 24. Denominators.

4. *Of Liquid measures.*

THe mets for liquid measures are founded from the * Jugg, which is 3 lb. 7 ounces of the water of *Leith*, or $102\frac{3}{10}$ solid Inches; their Denominators are as followeth, * The standard Jugg of Stirling.

Quart Pint Chopins Mutchkins Gills.

Gallon 4 : 2 : 2 : 2 : 4 Denominators.

3 or 14 Gallons make a Puncheon of high Countrey-wine.

10 Gallons make a Salmond Barrel.

The measures for *Burdeaux* Wine are these following,

Pipes Puncheons Gallons.

Tun 2 : 2 : 17. Denominators.

Half a Puncheon of the said *Burdeaux* measures being $8\frac{1}{2}$ Gallons is the Barrel for Herring, whereof 12 make a Last.

5. *Of dry measures.*

DRy measures are founded from the foresaid liq measures whereof 21 Pints and a mutchkin of t water of *Leith* makes a * firlet, which will be 2173. solid Inches which is 1 foot 445. 9 Inches. Th Denominators are as followeth,

* *The standard firlet of* Linlithgow.

Bolls firlets pecks 4pts. gills
Chalders 16 : 4 : 4 : 4 : 85 Denomi

The firlet for metting bear, malt or oats (whi are called heaped Corns) contains 31 pints, which 3171. 3 solid Inches. That is 1 foot 1443. Inches.

18 Bolls and $\frac{1}{2}$ is counted a Last of Ry.

The half Boll mett of the water measure of *Lei* containeth 9 Pecks.

6. *Of time.*

THe measures for time are first, the year founde from the motion of the Sun upon the Ecliptick each year containing one Revolution. Secondly the da is founded (according to modern Astronomers) fro the Motion of the Earth upon the axis thereof; eac day containing one Revolution. A year contains nea $365\frac{1}{4}$ dayes, each day contains 24 houres. The De nominators of minuts, seconds, &c. are sexagenary and consequently follow the rules in sexagenary Arith metick.

52 Weeks and { 1 Day makes a common year. (year 2 Dayes makes a Bissextile or Leap.

For the dayes in each moneth take this following Rhym.

Thirty dayes just hath September,
April, June, *likewise* November.
Feb. *twenty eight*; *Leap-year add one*:
But all the rest hath thirty one.

The

The Denominators of several goods.

THe Denominators for paper are as followeth,

Rimm Quair Sheet

Ball 10 : 20 : 25 Denominators.

Ten hides or the like is called a daker, 12 is called ozen, 20 a score.

A Comparing of the values, &c. of other Kingdoms to ours.

IN *Scotland* we oftentimes keep our account by marks, which is the $\frac{2}{3}$ of a pound, and the $\frac{1}{12}$ an Englisn merk, and oftentimes by Dollers; which ither called Legg or Cross-dollers, being 2 lb. 16 *ss. ots*, or elss Rix-dollors, being 2 lb 18 *ss. Scots.*

In *England* and *Ireland* they keep their account of oney as we do; their pound, &c. being 12 of ours.

The *Flemish* keep their account the same way by vers, soulds and deniers; the Liver or pound being of ours. As also the *French* their Liver being 18 sh. *ots*, and at *Florence* and *Legorn* the Liver being 9 sh. *ots.*

At *Rome* they keep their account decimally by Dus, Julios & Bajoches. The Ducat being 3 lb. 12 sh. *Scots*, d at *Muscow* they keep their account the same way. Ruble, Greyens and Cupecks, their Ruble being . 16 sh. *Scots.*

In the Low-Countreys their Denominators are

Stuivers pennies

Guilders 20 16

Their Guilder is 1 lb. 2 sh. *Scots.*

At *Dansick* their Denominators are as followeth,

Grois Deniers

Guilder 30 18. Denominators.

They keep their account the same way through *Poled*; their Guilder being 18 sh. *Scots.*

At *Spain* their Denominators are as followeth,

Rials merviedes

Ducats 11 34 Denominators.

CHAP.

CHAP. II. Addition.

Addition is the collecting, or gath
ing of two or more Integers or Fractions
into one ſumme.

1. Rule of Integers.

TO add the Table get in minde;
Then ſet all places of one kinde,
Under each other in a row,
As by Examples I ſhall ſhow.
Then firſt begin nixt the right hand,
And add each row as they do ſtand;
Setting the units down below,
And add the Tens to the nixt row:
And ſo go on unto the laſt,
Then place the tens of that which paſt.

The ſence.

TO add, you muſt get the following Table in
memory; then ſet all the places of one kin
(of thoſe you would add) under each other in rows
units under units, tens under tens, &c. Then
begin nixt the right hand and add up all the firſt r
and ſet down the units of the ſumme under that ro
and add the tens to the nixt row, and ſo add up
row and proceed to the end; where you muſt
down the tens alſo, becauſe you have no place to
it to.

T

c use in Addition.

Ake the figures in the left side for guide, and so add to each of those in ead, and in the an- f meeting you have total. As in the line you see a Ci- which neither in- eth nor diminish- But in the second you must say 1 and 2, then 1 and 2 is 3, 1 and 3 is 4, &c. to the end e line, and so proceed with the rest, as they follow in Table.

The Table of Addition and Substraction.

0	1	2	3	4	5	6	7	8	9	
1	2	3	4	5	6	7	8	9	10	
2	4	5	6	7	8	9	10	11		
3	6	7	8	9	10	11	12			
4	8	9	10	11	12	13				
5	10	11	12	13	14					
6	12	13	14	15						
7	14	15	16							
8	16	17								
9	18									

. Example.

38689	4
80576	|
00543	|
78657	|
09847	4
09248	
137560	

2. Example.

3789	4
3587	|
0538	|
0057	|
0031	4
5700	
13702	

3. Example.

37876	1
58705	|
39007	|
56365	|
191953	5

he 1 Example I add first up the row of units, where de 40, which is 0. and carries 4. which I add to the , and so proceed to the end, where I finde 13 in last row, which I set down, because there is no e to carrie the ten to.

To prove addition of Integers, cast away the nines n the particular summes; likewise from the totall, if the remainders of both be equal * you have ought well, otherwise not.

* *Ax.* 3.

The

The 2. Rule of Fractions.

For Fractions Addition.
In one Denomination,
Add ſtill up the Numerators,
Notting how oft Denominators
You have to add to the nixt row;
Then ſet the exceſs down below,
And ſo go on unto the laſt:
Then place what came of that which paſt.

The ſence.

FOr Addition in Fractions being all of one Denomination, add alwayes up the Numerators, obſerving ſtill when the ſumme exceeds the Denominator for ſo many times as it exceeds, ſo many have you to add to the nixt row towards the left hand; then ſet the exceſs, which is over the Denominators under the row which you added, and ſo proceed to the laſt row which if it be Integers, add that which came of the row nixt it towards the right hand thereto, and work *as before is taught. But if the laſt row be not Integers, you muſt ſet down that which came thereof towards the left hand.

*Rule of Integers.

Now ſeeing the Coins at *Rome* are decimal, I beg therwith, as followes

1. *Example decimal Fractions.*

D.	I. B.	
6080	01	
4900	00	5
3785 :	78	
5387 :	63	
2857 :	36	
2979 :	20	5
25989 :	98	

2. *Example of* Scotiſh *Coins.*

lb.	ſh.	d.
3867	13	08.
2079	15	11.
3786	19	05
7087	10	03.
9869	05	10
26691	05	01
22823	11	05

For the 1. Example of decimall parts the work is ſtill ſame as with Integers. For the ſecond Example dd firſt up the row of pennies; where I find 3 ſh. 1d. he Denominator being 12.) then I ſet down the . and carries the 3ſh. to the row of the units of ll. which I add up and finds 25. that is 5 to be ſet wn, and 2 to carry, as in Integers (the Denomi-or. 20 being compleat tens) then I add up the tens hill. and finds 6 tens, which is 3 lb. which I carry the pounds, and ſo proceeds, as before with the egers.

Example of weight Aver.

ſt.	lb.	Ou.	dr.	gr.
84.	10.	13.	15.	30.
25.	15.	10.	11.	33.
56.	12.	12.	10.	25.
53.	14.	15.	13.	35.
171.	06.	05.	04.	15.
86.	11.	07.	04.	21

4. *Example of liquid meaſ.*

gall.	Q.	p.	ch.	m.	g.
84.	3.	1.	0.	1.	2.
25.	2.	0.	1.	0.	3
17.	3.	1.	1.	1.	2
18.	1.	0.	1.	1.	1
96.	3.	0.	1.	1.	0
61.	3.	1.	0.	1.	2

5. *Example of dry meaſures.*

Ch.	bo.	fi.	p.	4pts.
13.	15.	2.	3	2
52.	10.	3.	3.	3
17.	12.	2.	2.	1
57.	13.	3.	3.	2
142	05.	1.	1.	0
128	05	2.	1.	2

o prove Addition in Fractions, if they be decimal, prove n as Integers; if not, add them all over again; except the line, then add the laſt total to the firſt line, and if the ſum qual to the firſt total * you have wrought right, otherwiſe

* *Euc.* Ax. 2.

CHAP.

CHAP. III. Subſtraction.

Subſtraction *is the taking of a Leſſe*
Integer or Fraction from a greater, or an equal
from an equal, and is therefore contrary
to Addition.

1. Rule of Integers.

For to ſubſtract, and then to finde
What reſts, the Table keep in minde;
Then firſt begin nixt the right hand,
And ſo ſubſtract as they do ſtand.
Still ſetting down what doth remain,
So that your work be not in vain.
If ye cannot Subſtraction
Make, from nixt row then borrow one;
Which after units name ye teen,
Except it be twelve or eleven:
But pay again to the ſame row,
As by Examples I ſhall ſhow.

The ſence.

TO ſubſtract, you muſt firſt have the foregoing Table in your memory ſubſtraction-wiſe, then place the Subſtrahend and Subſtracter, as in Addition, *viz.* units under units, and tens, &c. Then firſt begin at this place which is nixt the right hand to ſubſtract the Subſtracter from the Subſtrahend, and ſet down the remainders below; and ſo proceed to the end: but if Subſtraction cannot be made, borrow an unite from the foregoing row, for which you muſt name teen, to

er the units name; except it make twelve or elleeven with the following figure; or you may take the figure in the Subſtracter from 10, and add the remainders to the figure in the Subſtrahend, and ſet the remainders or ſumme below, as before. But you muſt remember, when you borrow, to pay that one again to the Subſtracter of that row from which you borrowed, or eſteem the figure above it in the Subſtrahend to be one leſs, which is all one thing.

Or you may add the complement Arithmetical of the Subſtracter to the Subſtrahend, and cut off the foremoſt figure nixt the left hand, and the reſt of the ſume the remainders required. The complement Arithmetical is found by taking all the figures from 9. except the laſt, which you muſt take from 10. as in the following Examples.

The uſe of the Table in Subſtraction.

FIrſt for Subſtrahends that are greater then the double of the Subſtracter, ſeek the Subſtracter in the left ſide, and the Subſtrahend towards the right hand, and above that in the head you have the remainders as 1. from 1. reſt 1. and 0. from 2. reſts 2, *&c.* Then 1. from 1. reſts 9, and 1 from 2. reſts 1, *&c.* But for other Subſtrahends, ſeek the Subſtracter in the head, and the Subſtracter below, and in the left ſide you have the remainders, as 1. from 2. reſts 1. Then 2. from 3. reſts 1. and 2. from 4. reſts 2, *&c.* as in the following Examples:

1. *Example of one nnmber from an other.*

Subſtrahend	8575	7	First I ſay 3. from 5. reſts 2, (which I ſet down) then 9. from 7. I cannot, but 9. from 17. reſt 8. then I pay one that I borrowed, and ſo proceed to the end.
Subſtracter	4793	|	
Remainder	3782	7	

2. *Exam-*

2. Example of three numbers from two.

Subſtrahends		Subſtracters.
3847	0	584
5873		573
		694
9720		
1851	0	1851
7869 Remainders.		

First I add the Subſtrahends together in one ſumme, and then the Subſtracters in another, and ſubſtracteth the ſumme of the Subſtracters from the ſumme of the Subſtrahends.

To prove Subſtraction of Integers, caſt away the nines from the Subſtrahend, and likewiſe from the Subſtracter and Remainders; and if that, which remaineth in the one be equal to that which remaineth in the other, * you have wrought right, otherwiſe not.

* *Euc. Ax. 3.*

The 2. Rule of Fractions.

For Fractions Subſtraction
In ane Denomination,
As Integers work Numerators;
But take from Denominators,
If Subſtraction cannot be made,
What reſt to Numerator add
Of Subſtrahend; ſet total down,
Pay to nixt row, as before ſhown.

The ſence.

FOr Subſtraction in Fractions of one Denomination, work the Numerators as before ye did the Integers; but when ſubſtraction cannot be made, take the Numerator of the Subſtracter from the Denominator, and add the remainders to the Numerator of the Subſtrahend and ſet down the total, then pay one to the nixt row, as before in Integers.

1. *Exampl*

1. *Example of decimal Fractions or Coin at* Rome.

D.	J.B.
376758.	57
279589.	37
97169.	20

2. *Example of* Scotiſh *Coin.*

lb.	ſh.	d.
37867	13	07
19395	15	10
18471	17	09

For the firſt Example of Decimal Fractions, the work is the ſame as with Integers.

For the ſecond Example, *I* ſay 10 d. from 7. d. I cannot, but 10 d. from 12 d, which is a whole ſhilling (that I muſt borrow) is 2d. and 7 d. is 9. to be ſet down; then one I borrowed and 5 ſh. is 6 ſh. from 3 ſh. I cannot, but 6 ſh. from 10 ſh. is 4 ſh. and 3 ſh. is 7 ſhil. to be ſet down, then one that I borrowed and 1 is 2. from 1 I cannot but 2 from 2 (being 2 tens, which is a pound that I muſt borrow) is 0. and 1 is 1 to be ſet down, then one that I borrowed and 5 lb. is 6 lb. from 7 lb. reſts 1 lb. &c. as with Integers.

3. *Example of weight Aver.*

ſt.	lb.	Ou.	dr.	gr.
357.	12.	13.	10.	32.
293.	14.	11.	13.	34.
063.	14.	01.	12.	34.

4. *Example of liquid meaſ.*

gall.	Q.	p.	ch.	m.	g.
35.	2.	0.	1.	0.	3.
22.	3.	1.	0.	0.	2.
12.	2.	1.	1.	0.	1

5. *Example of dry meaſures.*

Ch.	bo.	fi.	p.	4pts.
32.	13.	2.	1	3.
10.	10.	3.	2.	1.
22	02	2.	3.	2

To prove *Subſtraction* in fractions, if they be decimalls prove them as Integers if not; add the remainders to the ſubſtracters, and if the total be equal to the ſubſtrahend you have wrought right, otherwiſe not. * AX. 6.

CHAP. IV. Multiplication.

MULTIPLICATION is the manifold augumenting or increasing of one number by another, compendiously performing the work of many Additions: But the manifold diminishing or decreasing of an Integer, or Fraction by a Fraction; compendiously performing the work of many Substractions.

1. Rule of Integers.

TO learn a-right to multiplie,
The Table get in memorie.
Then first set down multiplicand,
And nixt let multiplier stand;
Multiplicand then multiply
First place of multiplier by;
Units set down, tens keep in minde,
To add when ye occasion finde
To the nixt row which is before:
And so go on, (if ye have more)
Unto the last, where place tens down;
So with each place, as shall be shown,
Observing well that they must stand,
A place still nearer the left hand.
Then add these products unto one,
In total whole product is shown.

The sence.

TO multiplie, you must first get the Table of multiplication, by memorie; then set down the multiplicand, and multiplier, and multiplie the Multiplica

y that figure of the multiplier that is nixt the right and, seting still down the units, and add the tens to he product of the nixt row, when you finde occasion, nd so proceed to the end: where you must set down he tens also. then as you wrought with the first place f the multiplier; so likewise work with the rest, if here be any more, observing to place their products ill one place nearer the left hand, as they increase emselves, then add the products together for the hole product.

The use in Multiplication..

*Take the figures in the left side for your guide, and so multiplie them by each of those in the head and in the angle of meeting you have their product, as in the first line you see an unit * neither multiplieth nor divideth, but in the second line you must say 2 times 2 is 4. and 2 times 3 is 6. and 2 times 4 is 8. &c. to the end of the line, and so proceed with the rest as they follow in the Table.*

The Table of Multiplication and Division.

	1	2	3	4	5	6	7	8	9	
2	2	4	6	8	10	12	14	16	18	
3	3	6	9	12	15	18	21	24	27	
4	4	8	12	16	20	24	28	32	36	
5	5	10	15	20	25	30	35	40	45	
6	6	12	18	24	30	36	42	48	54	
7	7	14	21	28	35	42	49	56	63	
8	8	16	24	32	40	48	56	64	72	* Ax. 12
9	9	18	27	36	45	54	63	72	81	

1. *Example.*

Multiplicand 3786547
Multiplier 5

Product 18932735

4
2X2
5

First I say 5 times 7 is 35, 5 and carrie 3. then 5 times 4 is 20 & 3 (that I carried) is 23, 3 & carrie 2, &c. To the end where I placed down the ten, which I was to carrie.

2. *Example.*

5783297865358

4626638288
2891648930
1734989358
2891648930

3098690993388

3. *Example.*

3 12
0X0 12
3 —
24
12
—
144 squar
0
0X0 12
3 —
288
144
—
1728 Cube

1X1
3

In the second Example, I multiplie the multiplican
first by 8, as in the first Example by 5, and after th
same manner by 5. the place nixt towards the left hand
and place the product one place nearer the left hand
and so I proceed with each of the figures of the mult
plier, and then I add all the products together for th
whole product.

In the third Example for squaring and cubing
I multiply 12 by it self, and the product is 144 for t
square; then I multiply the square 144 by the giv
number 12, and the product is 1728 for the Cube.

Rules for Contracting Multiplication

1. RUle. If either the Multiplicand, or mul
plier, or both have Ciphers towards the
hand, multiply the rest, except the Ciphers, a
add so many Ciphers to the end of the product,
are in the end of the multiplicand and multiplier.

1. Ex

1. Example.

5786 8
20 7X7
2

115720

2. Example.

440 8
60 3X3
6

26400

2. Rule, if there be Ciphers in the midle part of the Multiplier, fill up their place in the product with Ciphers; and so work with the rest, as before.

1. Example.

3456
406 0
0X0
20736 1
138240

1403136

2. Example.

2987
3004 8
2X2
11948 7
896100

8972948

3. Rule, if the multiplicand and multiplier consist of many places, make a Table for the Multiplicand, by setting down the Multiplicand for 1, and double it for 2, and add that which belongth to 1, to that which belongeth to 2 for 3, and to that which belongeth to 3. for 4, and so proceed to that which belongeth to 10, from which cut off that place which is nixt to hand; (being a Cipher) and if the remaining figures be equal to the Multiplicand, the Table is right otherwise not.

3786548
987654

15146192
18932740
22719288
26505836
30292384
34078932

3739799278392

5
6 X 6
3

1	3786548
2	7573096
3	11359644
4	15146192
5	18932740
6	22719288
7	26505836
8	30292384
9	34078932
10	37865480

These kinds of Tables are easily made by those rods Invented by the most famous *Iohn Lord Napier*, Baron of *Marchiston* in *Scotland*, which rods are of the greatest use of any Invention extant, (except the Logarithms Invented by the same Lord.) To make the Table thereby, first tabulat the Rods by placeing the rods with the figures of the Multiplicand in the head, each after one another in order, in form of a Table; Then seek each of the figures which are in the margin of the Table upon the margin of the Table made by the rods (which are placed on the edge of the box, wherein the rods are) and then first set down the Multiplicand in the head as before, for 1. then for 2. set down first that figure or cipher which is in the first triangle nixt the right hand; then add these which are in the nixt two triangles (making a Rhombus, or Lozenge figure by the two rods) together, and if the totall exceed 10, set down the units, and carrie the ten to the nixt two triangles and so proceed to the left hand to the last triangle which set down, and so with the rest of the figures as they follow in the Table.

But to multiply by the rodds, without making a Table, tabulat the Multiplicand, as before, then first seek that figure of the Multiplier which is in the place of units, upon the margent of the box: and so find

he product thereof as before is taught; Then if there e any more places, nixt seek the figure upon the mar-ent of the box, which is in the place of tens, and fin-ing the product, as before, set it under the foresaid roduct of units: observing, to place it one place earer the left hand. And so proceed with the rest, f there be any more places, and add them, as in com-non Multiplication.

Example.

240
257
1680
1200
480
61680

6
3 X 3
5

TO do this, I Tabulat the Multiplicand 240, and then I seek first the 7. (which is in the place of units) in the margent of the box, and find the figure in the first triangle o, and in the nixt Rhombus, their is o. and 8. which makes but 8, and n the Rhombus nixt to that, there is 2 and 4. which is , and in the last triangle there is 1, which is in all 680. for the first product, and so I proceed with the st of the products, and find the product of all 61680. hich was required.

To prove multiplication, cast away the nines from he multiplicand, and likewise from the multiplier, nd multiply their remainders together, and cast away he nines from the product thereof, and likewise from he product of your work * and if the remainders be e- * Ax. 12 uall, you have wrought right, otherwise not.

2. Rule of Fractions.

IN Fractions, to multiplie,
As Integers, work each partie.

The ſence.

TO multiplie in Fractions, work both what Numerator and Denominator, as before with the Integers, that is to ſay, multiplie Numerator by Numerator and Denominator by Denominator.

By which you may ſee that decimal fractions differ not from the Rule of Integers, only you muſt cut off as many figures from the product towards the left hand, as there be figures of decimal fractions in both the multiplicand and multiplier.

1. *Example of decimal Fractions or Coyn at* Rome.

Ducats J. B. 3
3787673 8 : 53 0 X 0
: 3 3
11363021 : 559

2. *Example of decimal Fractions or Coyn at* Rome

Ducats J. B. 6
3786738 : 45 6 X 6
: 07 7
26507 1 : 6915

In the firſt Example, I muſt cut off three figures for the decimal fraction of the product, ſeeing the multiplicand hath two figures of Fraction, and the multiplier one. And for the ſame reaſon, in the ſecond Example I muſt cut off four figures for the decimal fraction of the product, ſeeing the multiplicand hath two figures of Fraction, and the multipliers as many. For the Denominator of the multiplicand in both, is underſtood to be 100, which multiplied by 10, the

Denominator of the multiplier in the first Example is 1000. and by 100 the Denominator of the multiplier in the second Example is 10000.

3, *Example*

$$\begin{array}{ccccc} 2 & & 2:3 & & 3 \\ 2 & \times & 2 & 6 & \times 6 \\ 1 & & 1:2 & & 2 \\ & & 2:6 & & \end{array}$$

4. *Example.*

$$\begin{array}{ccccc} 1 & & 1:3 & & 3 \\ 3 & \times & 3 & 6 & \times 6 \\ 3 & & 3:5 & & 5 \\ & & 3:15 & & \end{array}$$

In both these Examples, I multiplie the Numerator by Numerator, and Denominator by Denominator, as in the Rule is directed.

5. *Example.*

$$\begin{array}{ccccc} 6 & & 15:17 & & \\ 0 & \times & 36:41 & & 8 \\ 0 & & & 4 & \times 4 \\ & & 90 \quad 17 & & 5 \\ & & 45 \quad 68 & & \\ & & 540:697 & & \end{array}$$

6. *Example of squaring and cubeing fractions.*

$$\begin{array}{ccccc} 3 & & 3:5 & & 5 \\ 0 & \times & 3:5 & 7 & \times 7 \\ 3 & & & & 5 \\ 0 & & 9:25 & \text{square} & 7 \\ 0 & \times & 3:5 & & 8 \times 8 \\ 3 & & & & 5 \\ & & 27:125 & \text{Cube.} & \end{array}$$

7. *Example of Integers and Fractions by an Integer.*

lb.	sh.	d.
35	17	08
		06
215	06	00

First I say 6 times 8d. is 48 d. that is 0 d. and carrie 4 sh. Then 6. times 7 sh. is 42 sh. and 4 sh. is 46 sh. that is 6. and carrie 4 tens of sh. Then 6 times 1 ten of sh. is 6 tens of shill. and 4 tens, is 10 tens of shill. which is 0 and carries 5 lb. seeing two tens of shill. is a pound. Then 6 times 5 lb. is 30, and 5 lb. is 35 lb. that is 5. and carrie 3. then 6 times 3 is 18, & 3 is 21. which I set down.

8. *Example of Integers and Fractions by Integers and Fractions.*

lb.	sh.	
22	18	
3	08	
lb.	sh.	04
9	03	20
68	14	
lb.	sh.	4
77	17	20

COnsidering that the sh. of the Multiplier is 20. 8 parts of a lb. which is the Integer, I say first 8 sh. by 8 sh. is 64:20 of a shill. (esteeming the shillings of Multiplicand to be Integers of shill. and consequently must have but an unite for its Denominator That is 4:20 of a sh. and carrie 6 tens; Then 8 sh. by 1 ten of a sh. is 8 tens of the 20part of a sh. and 6 tens is 14 tens, which is 0. and carrie 7 shillings. Then 8 sh. by 2 lb. is 16 sh. and 7 sh. is 23 sh. that is 3 and carrie 2; Then 8 sh. by 2 tens of a pound is 16 tens of a shilling, and 2 tens is 18 tens, which is 9 lb. to be set down: Then I multiplie the multiplicand by the pounds of the multiplier, as in the 7 Example, and add the product thereof to the other for the whole product.

9. *Example of Integers by Integers and Irregular Fractions.*

36	
5 2	
180	
18	
198	

FIrst I multiplie the Multiplicand 36 by 5. the Integers and the Product is 180. to which I add the one half of the Multiplicand 36, which is 18 and the product is 198.

The general proof for multiplication in fractions, is to prove the Numerators, and likewise the Denominators, as in Integers.

CHAP.

CHAP. V. Division;

Division is the taking of a Lesser Integer or Fraction out of a greater, or an equal out of an equal, so many times as the one is contained in the other; Compendiously performing the work of many Substractions: And is therefore contrary to Multiplication, as Substraction is contrary to Addition.

1. Rule of Integers.

FOr to Divide, keep well in minde
The Table which before you find;
Place, and begin nixt the left hand,
For to divide as they do stand:
Trying how oft the divisor,
Ye'll find in dividend thats more,
So oftentimes, as ye it get,
In quotient ye must it set.
By divisor it multiplie,
Product from Dividend take ye,
So set down what doth remain,
Then with nixt place begin again,
For to try with your divisor,
And so worke as you did before.
This worke renue unto the end,
Then note what rests of dividend,
Make it a fractions numerator.
And divisor Denominator.

The sence.

TO divide, you must have the foregoing Table of multiplication Division-wayes in your memorie.

Then

Then place your dividend and divisor, and begin nixt the left hand, and try how oft you can get the divisor in the first part of the dividend; which is more then the divisor; and so many times as you find it, set in the quotient, and multiplie the divisor thereby, and substract the product thereof from the first part of the dividend, and set down the remainders; and then you must begin again to try, and work as before, so oft, untill the remainders be less then the divisor: then make that remainder the numerator of a fraction, and the divisor the Denominator thereof.

The use of the Table in Division.

First, for dividends that are greater then the square of the divisor, seek the Divisor in the left side, and the nearest dividend under that which is given towards the right hand, and above it in the head you have the quotient, and by substracting the dividend in the table, from that which is given, you have the remainders; as 1 unto 1. I find 1 time, and 0 to remain, and 1. into 2, 2 times 0 remains, &c. Then 2 into 2, 1 time, and 0 remains, also 2) 4 (2 and 0 remains 2) 5 (2 and 1 remains, &c. But for other dividends, seek the divisor in the head, and the nearest dividend under that which is given, below it, and in the left side you have the quotient, and find the remainder, as before as 2) 3 (1 rests 1: then 3) 4 (1 rests 1, 3) 5 (1 rests 2, &c.

1. *Example.*

Dividend quotient 8 First I say how of-
Divisor 5.) 384567 (76913 $\frac{2}{5}$ 6 X 6 times 5 in 38 (be-
3401 (2 remai. 5 5 cause I cannot have 5 into 3)

I find it 7 times (which 7 I place in the quotient) and 3 to remain; (which 3 I place under the 8) then I say how oftimes 5 into 34 (which is the 3 that remained with the following figure) I find 6 times but 0 to remain, and so I proceed to the end, where there rests 2. which makes 2 : 5 with the divisor as in the rule.

2. *Exam-*

2. Example.

Diviſor	Dividend	quotient.	
37867)	98767 58	(260	31338
1. Product	75734 .		37867
			8
Reſolvend	230335		5X5
2. Product	227202.		4
Remainder	31338.		
Proof	9876758		

First I ſay how oftimes 3 into 9 I find 3 times and 0 to remain: but 3 times 7 is 21. which I cannot get out of the figure 8 (which followeth the 9) therefore I take it 2 times, and 3 to remain; which makes 38 (with the foreſaid 8) and 2 times 7 is 14. which I can eaſily get into 38. Therefore I ſet 2 in the quotient. then I multiply the diviſor thereby, and ſets the product under the firſt part of the dividend, that is to ſay, I ſet the units of the product ſo many places after the 9. as there be places in the diviſor after the 3. (which I tryed with) and ſubſtracts it there from; and then bring down the following figure of the dividend, to the end of that remainder for a new dividend, called the reſolvend. Then Secondly, I ſay, how oftimes 3 into 23 (being ſo much as would be before the 3. if it were ſuppoſed to be moved one place nearer the right hand) I finde 7. times, and 2 to remain, which makes 20. (with the following Cipher) but 7 times 7 is 49. which I cannot get out of 20. Therefore I take it 6 times and 5 to remain, which makes 50. and 6 times 7 is 42. which I can eaſily have into 50. therefore I ſet 6 in the quotient, and multiplies the diviſor thereby (as before with the 2) and ſubſtracts the product thereof from the reſolvends, and bring down the following figure of the dividend, as before for the ſecond reſolvend. But for as much as I cannot get the 5 with the 7 that follows one time out of it, I place a Cipher in the quotient, and calls it remainder; and ſo makes a fraction thereof with the diviſor, as in the rule.

Rules

Rules for contracting Division.

1. RUle, if the Divisor have Ciphers towards the right hand, cut off so many places from the Dividend towards the right hand; which place after your remainders when your work is done.

1. *Example.*

45870) 37867|3 (8
36696
11713.
45870

11713
45870
8
7X7
6

2. *Example.*

3200) 345|87 (10
32.
2587
3200

2587
3200
1
0X0
5

2. Rule, if you be to divide by 5, double the dividend and cut off the last place from the product, so have you the quotient in Integers and decimal fractions.

1. *Example.*

587654
2
1175308
10

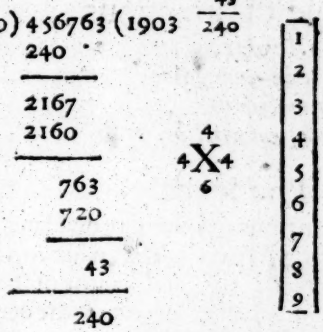
2. *Example.*

7654987
2
15309974
10

3. Rule, if your Dividend and Divisor consist of many figures, make a Table for the Divisor as before in Multiplication for the Multiplicand.

To divide by the rods, without making a Table, tabulat the divisor, as before you tabulated the Multiplicand; then you have that divisor multiplied by all the figures to 10, out of which you may chose such convenient products, as will be nixt less to each of the Resolvends, and set down the figures answering to each

ach of the ſaid products in the quotient, as they follow by Courſe, and ſo work. As in the following xample, where there is a Table annexed for making he rods more clearly underſtood.



To do this, I ſeek firſt for the neareſt product under 456 (which is the firſt part of the dividend) being 240. for which I ſet 1 in the quotient, and ſubſtract the 240 from the 456 aforeſaid, and there reſteth 219; to which I bring down the 7 that followeth in the dividend, as for the Reſolvend: and ſo proceed therewith, as before is taught, with each Reſolvend.

Note that this Compendious Rule in diviſion with the Rods, as alſo in multiplication, may ſerve for any other Rule, which requireth multiplication, or diviſion.

To prove diviſion, caſt away the nines from the quotient, and likwiſe from the Diviſor, and multiplie their remainders, and caſt away the nines from that product together with the remainders of your diviſion (being the numerator of the fraction) and note your remainders; then caſt away the nines from the dividend, and if the remainders thereof be equal to the foreſaid remainders, which was noted, you have wrought right, otherwiſe not. But ſuch whoſe products are ſet down as in the 2 example, you may alſo prove them, by adding *Ax 11. & 20.

adding all the products together with the remainder
and if the totall be equall to the dividend, you ha
*Ax. 20. wrought right, *otherwise not.

2. Rule of Fractions.

IN fractions for to Divide,
Take Dividend to be your guide;
Contrariwayes then multiplie,
What is produc'd quotient will be.

The sence.

To Divide in fractions, make the dividend to b
your guide in working, that is to say, what comes o
the numerator thereof, is the numerator of the quo
tient, and off the denominator thereof, is the denomi
nator of the quotient; then multiplie contrary wayes th
numerator of the dividend by the denominator of th
divisor, and the denominator of the dividend by th
Numerator of the divisor, and that which is produce
of these multiplications is the quotient required.

By which you may finde that in decimall fractions
the worke differeth not from the rule of Integers, onl
you must consider, that the first figure of the quotien
is alwayes of the same denomination with that figur
or cipher of the dividend, which would stand over th
place of units in the divisor, if Imagined to be plac'
under the dividend.

1. *Example of Decimal fractions or Coyn at* Rome.

J.	Ducats	J.B.pts.	Ducats	J.B.	3
:3)	11363021	: 559	(37876738	: 53	0X0
	2222212	10(0			3

Now considering that the $\frac{3}{10}$ in the first part of th
operation, is supposed to stand under the place of mi
lions, therefore the unit would stand if there were an
under the place of tens of millions, whereby the fir
figure in the quotient is tens of millions.

2. *Exam*

2. *Example of decimal fractions or Coyn at* Rome.

J. B. Ducats JB. pts. Ducats. J. B. 6
'07) 265071 ' 6915 (3786738 ! 45 6X6
56452 533(Q 7

Likwise in this Example the 7 'ioo in the first part of the operation, is supposed to stand under the place of tens of thousands; therefore the units would stand under the place of millions: and Consequently the first figure in the quotient is Millions.

3. *Example of Integers and decimal Fractions.*

)498'75(62'34 3
123(3 6 8
6X6
8

IN this Example the 8 is supposed to stand under the place of tens; in the first operation, and consequently the first figure of the quotient is tens.

4. *Example of Integers and decimal Fractions.*

'9)487867'8(617553 3
474- 79
138
79- 6
596 3X3
353- 7
437
395-
428
395-
33-
487867'8

IN this Example the place of units is supposed to stand under the place of tens of thousands; so that the first figure of the quotient must be of the same name: or seing the divisor & dividend have a like number of places of decimal Fraction; therefore the figures in the quotient are all Integers.

	5. *Example.*	6. *Example.*	7. *Example.*
	N. D.	N. D.	N. D.
Dividend	3 : 4	Dd. 3 : 5	Dd. 5 : 8
Diviſor	1 : 2	Dr. 3 : 4	Dr. 3 : 5
Quotient	6 : 4	Q. 12 : 15	Q. 25 : 24

In theſe three Laſt Examples, I multiplie the Numerator of the Dividend by the Denominator of the diviſor the Numerator of the quotient, and the Denominator of the Dividend by the Numerator of the Diviſor, for the Denominator of the Quotient as in the Rule.

8. *Example.*

lb.	ſh.	d.	lb.	ſh.	d.
5) 33	16	08	(6	15	04
3	21	(08	lb.		

Firſt I ſay how ofttimes 5 into 33. anſwer 6 times, and 3 remaining which is 6 tens of ſhillings, and 1 ten is 7 tens; wherein I finde 1 time 5 and 2 remaining, which makes 26. wherein I find, 5 times 5. and 1 remaining, which is 1 zd. and 8d. is 20d. wherein I finde 4 times and 00 remaining.

To prove Diviſion of fractions, if they be decimal, prove them as Integers, If not, prove each Multiplication *viz.* of the Numerator of the Dividend by the Denominator of the Diviſor, and of the Denominator of the Dividend by the Numerator of the Diviſor.

II. PART Derivative.

CHAP. I. Reduction.

REduction is that, whereby we reduce Integers or Fractions from one Denomination to another.

1. *Rule.* To reduce Fractions of a Fraction to a Fraction.

For Fractions of a Fraction, Work as Multiplication.

The sence.

TO reduce Fractions of a Fraction to a Fraction work as before in Multiplication of Fractions' that is, multiply the Numerators by the Numerators' and the Denominators by the Denominators.

1. *Example, to reduce* 3 d. *being* 3. 12 *of* 1. 20 *of a pound.*

N. D.
3 : 12
1 : 20
3 : 240

of 6 X 6 240. for the Denominator of the fraction. Then seing one of the numerators is an unite * which multiplieth not, therefore the Numerator of the Fraction is 3, making in all 3 : 240 of a pound as was required.

First I multiply the Denominator 12 by 20, the product is

3
2

*Ax. 12.

2. Example	N:	D:	D.
N.	4:	5	5
4	5:	6	6
5	7:	8	of
20	140	240	30
7			8
140			240

3. Example.	N.	N:	D.	D:
	7	7:	8	7
	5	5:	7	of
	35	5:	8	56
	5	175	448	8
	175			448

To prove your work in this rule, you must work the same way as in Multiplication of Fractions.

---

2. Rule, to reduce fractions to their least terms, called abbreviation of fractions.

FOR the least terms, both terms divide
By 2, 3, 5 or 7, for guide.
Or greatest term divide by least,
Then Divisor by what doth rest.
And so proceed, thus to divide;
When nothing rests, that will be guide.

The sence.

TO reduce Fractions to their least terms, divide both the numerator and Denominator by one number, as by 2, if they be both even; or by 3, if they be both compound thereof; or by 5, If the last place in both be either a 5 or (0) or else by 7, if they be both compound thereof. But if they cannot be divided by these aforesaid numbers, it shows that they cannot be abbreviated by any single figure. Or you may abbreviat more conveniently thus, divide the greatest term by the least, and the divisor by that which remains; and so proceed untill nothing remain. Then is that divisor which was last the number to divide both terms by, *Eu: 2. 7 being the greatest common measure. 1. Exam-

1. *Example.*

2) 6 (3 | 3) 3 (1

abbrevat 6'12 thus 2) 12 (6 | 3) 6 (2

First I divide, both by 2, then it is 3, 6. then I divide again by 3. and the quotient is 1, 2. the leaſt terms required.

2. *Example.*

abbr. 17) 51 (3 anſr. 1/3

51

51

00

3. *Example.*

154 (770) 5 anſr. 1/5

770

770

00

4. *Example.*

156) 936 (4

abbrev. 636 624

12) 156 (13

12

36

36

00

N.

12) 636 (53 anſ. 13/53

60

36

36

00

Note, that when the leaſt divides the greateſt, and leaves no remainders, that the Quotient will be the Denominator, and an unite the numerator thereto, ſeeing it meaſurs itſelf by an unit: *Eu. ax.* 6. 7.

To prove your work in this rule, you may only prove the laſt Diviſion of both termes (obſerving that nothing ought to remain in either) as before.

---

3. *Rule,* To reduce any number of Fractions given to one denominator.

FOR one denomination,
Work as Multiplication
With all your Denominators,
Then your product for Numerators,
Divide by each Denominator,
And multiply by Numerator.

The ſence.

TO reduce anv number of fractions given to one denomination, work with all your denominators as in multiplication of fractions, that is to ſay, multiply all the denominators for a generall denominator to all. Then to find the numerators of each of the ſaid fractions agreeing to the ſaid generall denominator, divide the generall denominator by each given denominator, and multiply the quotient by their Numerator, and the product is the numerator thereof agreeing to the generall denominator, which was required to be done.

1. *Example.*

N.	N:	D:
60	1:	2:
30	2:	3:
90	3:	4:
48	2:	5:

120

2 3 4 5

6 4 24 5

2) 120 (60
(0

3) 120 (40
0(0 2
80

4) 120 (30
0(0 3
90

5) 120 (24
2(0 2
48

To do this, I multiply all the denominators, and the product is 120 for the general denominator. Then for the first numerator agreeing thereto, I divide the foreſaid general Denominator by 2 (the given denominator of the first fraction) and the quotient is 60. for the numerator agreeing to the general denominator, ſeeing the numerator of the given fraction is an unite * which multiplieth not. Then for the ſecond numerator agreeing to the foreſaid general denominator, I divide the product 120 by 3. (the given denominator of the ſecond fraction) and the quotient is 40 which multiplied by 2 (the numerator of the ſecond given) and the product is 80 for the numerator of the ſecond agreeing to the general denominator, and ſo of the reſt.

*Ax. 12.

2 *Example*

2. *Example*

```
21 | 3: 5 }
20 | 4: 7 }  35
                 5
                 7
                 ---
                5)35(7
                 (0 3
                    ---
                    21
                7)35(5
                 (0 4
                    ---
                    20
```

3. *Example.*

```
3 | 1: 5 }
10 | 2: 3 }  15
                 5
                 3
                 ---
                5)15(3
                 (0
                 5
                 3)15(5
                 (0 2
                    ---
                    10
```

To prove your work in this rule is to observe that if nothing remain you have wrought right, otherwise not. *Ax. 13.

---

4. Rule. To reduce improper fractions to integers and proper fractions.

Improper when, the numerator
Still divide by denominator.

The sence.

TO reduce improper fractions to integers and proper fractions, divide the numerator by the denominator thereof, and the quotient is an integer, and the remainders if there be any, is the numerator to the proper Fraction, and the Divisor denominator as before.

1. *Example to reduce 367 : 5 to an Integer and proper Fraction.*

```
                 2   1
5)367(73 2/5   7X7
   1(2          5
```

To do, which I divide the Numerator 367 by the Denominator 5, and the quotient is 73 2 : 5 which was required.

2. *Exam-*

2. *Example of* $\frac{584}{7}$

7) 584 (83 $\frac{3}{7}$ 2
2(3 8X8
7

3. *Example of* $\frac{504}{6}$

6) 504 (84 3
2(0 0X0
5

4. *Example of* $\frac{13}{2}$

2(13 (6 $\frac{1}{2}$ 6
(1 4X4
2

5. *Example of* $\frac{15}{5}$

5) 15 (3 3
(0 6X6
5

To prove your worke in this rule you may only prove the Division as before

4. Rule to reduce Integers or Fractions to any given Denominator.

FOR to reduce to any name,
Denominator of the same
By Numerator Multiplie,
Divide Denominator by,
What is produced, is Numerator
Unto the given Denominator.

The sence.

TO reduce Integers, or Fractions to any given Denomination, multiplie the numerator by that Denominator, which you would have it reduced into; and divide the Product thereof, by its own Denominator (which if of an Integer, * is alwayes an unite, * which divideth not) and the Quotient is the numerator agreeing to the given Denominator.

* Def. 44
* Ax. 12.

1. *Exam.*

1. Example to reduce 2' 5 of a pound to pennies.

240 5 6
2 3 X 3
5) 480 (96 2 2
3 (0

To do which, I multiplie 240 (the denominator of pennies by 2. (the Numerator of the given Fraction) and divide the product 480 by 5 (the denominator thereof; and the quotient is 96 pennies required.

2. Example, to reduce 548 lb. to ſhillings.

548 8
20 7 X 7
10960 ſhlll. 2

Firſt, I multiplie the number 548 (being the Numerator) by 20 (the Denominator of ſhillings) and the product is 10960 ſhillings, *ſeeing an unite (being the *Denominator of Integers) divideth not. * Ax. 12. *Def. 44

3. Example to reduce 10960 ſhillings to pennies.

10960 0 1 7
12 3 X 3
21920 0 3
10960 1
131520

To do this, I multiplie 10960 ſhillings by 12. (the Denominator of pennies in regard of ſhillings) the product is 131520 pennies, *ſeeing an unite (being the Denominator of ſhillings taken here as Integers in regard of pennies) divideth not. *Ax. 12.

4. Example to reduce 368 lb. to pennies.

368 lb. 8
240 3 X 3
14720 6
736
88320 pennies

To do this, I multiplie the 368 lb. by 240 (the denominator of pennies in regard of pounds) and the product *is 88320 pennies required. * Ex. 2. and 3.

5. *Example to reduce* 158 lb. 16 ſh. 8. d. *to pennies.*

lb.
158 6
20 8X8
——— 2
3160
16
———
3176 ſhillings
12 8
——— 5X5
6352 3
3176|8
———
38120 pennies.

* Ex. 2.
* Ex. 3.

TO do this, I firſt * reduce the 158 lb. to ſhillings, and adde in the 16. ſhillings, the total is 3176 ſhillings; which I * reduce to pennies, and adde in the 8 d. and the total is 38120 pennies required.

6. *Example to reduce* 367 ft. 12 lb. 13 ou. 15. dr. *to grains.*

ft.
367
16 7
——— 7X7
2202 7
367(2
11
———
5884 lb.
16 7
——— 8X8
35304 7
5884(3
11
———
94157 ou.

ou.
94157
16 8
——— 8X8
564942 7
94157(5
11
———
1506527
36
——— 8
9039162 0X0
4519581 0
———
54234972

To do this, I multiplie the ſtones by 16 (the Denominator of pounds) and by adding in the 12 lb. there is produced 5884 lb. which I multiplie by 16 (the Denominator of ounces in regard of pounds) and by adding in the 13 ounces, there is produced 94157 ounces; and ſo of the reſt, as in the work. 7. *Exam-*

7. *Example to reduce* '3678 lb. *to ſhill. and pennies.*

'3678	6	
20	3X3	
	2	
ſhill. 7 | 356		
12		
712	5	
356	6X6	
	3	
pennies 4 | 272		

TO do this, I multiplie the Numerator '3678. by 20 (the Denominator of ſhill.) and cut off as many places from the product, 73560 as the Numerator hath, which is 4 places; (which is as much as to divide by the Denominator 10000) and there cometh out 7 '356ſh. neglecting the Cipher, *Def. 8. becauſe it is of no uſe; Then I multiplie the 356 by 12 (the Denominator of pennies in regard of ſhill) there is produced 4272 (from which I cut off three places) the number of places in the laſt Numerator and there commeth out 4 '272 pennies Required.

8. *Example to reduce* '567 *Stone weight to Pounds* &c.

'567	0	
16	0X0	
	7	
3402		
567		
pounds 9 | 072		
16		
432	0	
72	0X0	
	7	
ounces 1 | 152		

TO do this, I firſt multiplie the Numerator, 567 by 16 the (Denominator of pounds) and by cutting off three places from the Product (according to the number of places in the Numerator) there is Produced 9 pound and '072. which multiplied by 16 (the Denominator of ounces in regard of pounds) and by cutting off three figures,

as

```
ounces 1|152
          16
        ----
        912        8
        152      2X2
        ----       7
drop 2|432
         36
        ----       0
       2592      0X0
      1296         0
      ----
gr. 15(552
```

as before, there is proceed, ownce and '15 with which I proceed, before; as you may see the work,

9. *Example to reduce 3'7 of any thing to do a decimal Fraction.*

```
                  1      8
7) 300000 ('42857 -  3X3
    2645(1            7
```

TO do this, place a convenient number of Ciphers to the numerator; (which is as much as to Multiplie it by such a decimal number as a Denominator thereto) and then I divide by 7 the Denominator, and the quotient is '42857,1'7 Required.

10. *Example, to reduce 7 d. to a decimal fraction.*

```
240) 700|0 (29 1/6
     48-          2
     ---        7X7
     220          6
     216-
     ---
      04-
4) ---- (1/6
     24
```

To do this, I add a convenient number of Ciphers to the Numerator 7. as before; and divide by 240 (the denominator of pennies in regard of pounds) and the quotient is 29 1 : 6 required.

11. *Exam*

11. *Example, to reduce 38120 pennies to shillings and pounds.*

```
                 sh.  lb.  sh.  d.
2) 38120 (317 |6 (158.  16.  08
   36 · 20) 11 (1
   ----
    21        8        5
    12      5X5      8X8
   ----       3        2
    92
    84
   ----
    80
    72
   ----
     8 d.
```

To do this, I divide first the 38120 pennies by 12 (the Denominator of penies in regard of shill.; The Quotient is 3176. shill. (seing the Denominator of shillings taken here as integers in regaird of penn. is an unite * which multiplieth not (and there is 8d to remain; Then I divide the 3176 shillings by 20. (the Denominator of shillings) the Quotient is 158 lb. (seing *the donominator of pounds is an unite * which multiplieth not) and there rests 16 sh. so that 38120 pennies is 158 lb. 16. 08 d. required.

*Ax.12.

*Def.44
*Ax.12.

12. *Example to reduce 4987 grains to drops, ounces &c.*

```
                 ou.  dr.  gr.
36) 4987 (138(8.  10.  19
    36 - 16) 128
   ----  ----        8
   138 drops 10     3X3
   108                7
   ----        3
    307      1X1
    288        0
   ----
Grains 19
```

To do this, I first divide the 4987 grains by 36 (the Denominator of grains in regard of drops) and the quotient is 138 drops; and 19. grains to remain; then I divide the 138. drops by 16 (the denominator of drops in regard of ounces) and the Quotient is 8 ounces and 10 drop to remain: so that 4987 grains is 8 ounces 10 drop 19 grains required.

11. *Exam-*

13. *Example, to reduce* 324 *merks to pounds.*

*Ex. 2, and 3.

324		3	0
2 lb.		0	0
2)648	(216	2	0
01	0		

*Ex. 11, and 12.

TO do this, first * I multiplie the 324 merks by (the Denominator of merks in regard of merks) product is 648 half merks which I divide by 3 (the Denominator of half merks in regard of pounds,) and the quotient is 216 lb. required.

This Example, or the like may be more easily demonstrated by the Golden-rule forwards.

To prove your work in this rule, cast away the nines from the Divisor, and likewise from the quotient, and multiplie your remainders, and cast away the nines from the product thereof together with the remainders of your division; Then cast away the nines from the Multiplicand, and likewise from the multiplier; and multiplie the remainders, casting away the nines from the product: and if the remainder thereof be equal to that of the foregoing product of remainders of your division, you have wrought right otherwise not.

Note that, if any operation be wrought only with Multiplication, or only with division, prove only the multiplication or division, as before.

CHAP. II. *Proportion.*

PRoportion is the similitude of *Ratio's*, being so its great use in the Mathematicks, called the golden rule; and is also called the rule of Three, by reason it requires 3 numbers to be given, to find out a fourth Proportional; being either simple, which contains forward and reverse; or compound, either forward

forward pure, forward and reverse, reverse pure, or reverse and forwards.

1. Rule, called the *Golden rule* or rule of Three forward.

THE Golden rule to work truely
Forward, thrid number multiply
By second, and by first divide
Their product, which to fourth will guide.

The sence.

TO work the Golden rule forwards, multiplie the third number by the second, or second by the 3d. (which is one & the same thing) and divide the product thereof by the first, and the quotient will be the fourth number required.

A generall rule for placing your numbers.

PLace that Denomination of which you have but one for the midle number, (being of the same denomination with the number sought) Then place that number which answers thereto, for the first number; and that number which is of the same denomination with the first, place it nixt after the midle number. Then if it be the compound rule which hath other two numbers of the same denomination, place that which answers to the first and midle number for the second number, and the other for the fifth number.

To know whither any question propounded, or any part thereof be of the forward or backward rule.

YOu must observe, that if more require more, or lesse require lesse, it is the forward rule. But if more require lesse, or lesse more, it is the backward rule.

1. *Exam-*

1. *Example. If* 100 *principal yeeld* 6 *interest in a year, what shall* 548 *principal give?*

```
lb.p. lb.J. lb.p lb.J. sh. d. 1
100: 6:: 548 : 32  17  07  5
          6
        ----
       32|88
          20
        ----
       17|60      1      6
          12      3 X    3
        ----
         120      8      5
          60
        ----
        7|20(100(1/5
         100
```

To do this, I multiply the third number 548 lb principal by the second number 6 lb. interest; the product is 3288, (which I divide by 100) by cutting off 2 figures towards the right hand, which is one, and the product is 32|88:100. Then I reduce the 88:100. to shillings and pennies, and finds it 17sh. 7d. 1:5 required.

2. *Example. If* 38 lb. *weight of any thing cost, by* pound, *what shall* 54 *weight cost at the rate?*

```
lb.w. lb.   lb.w. lb.  sh.  d.  10/19
38:  67:  :54:  95   04   02
          67                      20        12
         ---                       8         8
         378                      ---      ---
        324                   38)160(4   sh 38)96(2
        ---                      152-        76
     38)3618(95      2      4     ---        ---
        342-         0 X    0       8-       20
        ---          0      5     ---     2)---(10/19
         198                      160        38
         190-
         ---
           8-
        ----
        3618
```

3. *Example*

3. Example. *If 52 Ells of any thing cost 40 lb. what shall 48 Ells cost at that rate?*

Ells lb. Ells lb. sh. d. 7/13

52 : 40 :: 48 : 36 18 05

40

52)1920(36 48 24

156 20 12

360 52)960(18 sh. 48

312 52 24

48 440 52)288(5

416 260

1920 24 28(14(9

960 2)

52(26(13

4. Example. *If 10 Guilders in Holland be worth 11 lb. Scots, what shall 459 Guilders be worth?*

guild. lb. guild. lb. sh.

10: 11 :: 459 : 504 18

11

459

459

lb. 504|9

20

sh. 18|0

Note that this Example might appear to belong rather to the rule of Reduction but in so far as all the operations of the 4 and 5 Rules of Reduction may be more clearly done, and demonstrated by this Rule; I thought it fit to give an Example thereof to show you that these Rules might easily be reduced unto this Rule.

To prove your work in this rule, work as in proving of your operations in the 5. rule of Reduction.

Examples of the Rule of 3 forwards in fractions.

1. *Example. If 2'3 of any thing cost 3'5 of a pound what shall 5'8 cost at that rate?*

Set them thus

$$\frac{2}{3} : \frac{3}{5} :: \frac{5}{8} : \frac{9}{16}$$

Multiplication and Division in Fractions.

$$\begin{array}{r} 3 \\ \hline 9 \\ 5 \\ \hline 45 \end{array} \qquad \begin{array}{r} 5 \\ \hline 40 \\ 2 \\ \hline 80 \end{array}$$

$$5)\overline{}(\frac{9}{16}$$
$$80$$

TO do this, it is required * to multiply the Product of the numerators of the 2d. and 3d., by the Denominator of the first, for a numerator to the fourth and the product of the Denominator of the second and third, by the numerator of the first, for a Denominator to the fourth.

Therefore I multiply 3 the denominator of the first by 3. the Numerator of the 2d, and the product thereof by 5. the numerator of the third (*, which is as much as to multiply the Product of 3 the numerator of the second, and 5 the numerator of the 3d, by 3 the Denominator of the first) the last product is 45 for the Numerator of the fourth. Then I multiplie 40 the product of the denominators of the 2d and 3d, by 2 the Numerator of the first, the product thereof is 80. for the Denominotor of the fourth. which fourth abbreviated is 9'16 required.

* Ax. 13.

2. Exa

2. *Example. If 1'2 ell of any lineing will serve 3'4 ell of Cloath, what shall 14 Ell of Cloath require?*

Ell. el. ell. l. ell. el. ell. l.

$\frac{3}{4} : \frac{1}{2} :: \frac{14}{1} : \frac{28}{3}$

$\frac{14}{56}$ $\frac{3}{6}$

)—(28 (9 $\frac{1}{3}$
6 3

To do this, I multiply 4 the Denominator of the first by 14. the numerator of the third, seeing the numerator of the 2d is an unit) for 56. the numerator of the fourth. likewise I multiply 2 the Denominator of the 2d by 3 the numerator of the first, for 6 the Denominator of the fourth; (seeing the Denominator of the 3d is an unite) so is the fourth 56' 6. * which abbreviated is 28' 3. that is 9, 1'3 * being reduced into an Integer and proper fraction. *2. Rule of Reduction.

*4. Rule of Reduction.

. Example: *If one foot of timber cost 12 shillings what shall 35' 4 foot cost at that rate?*

foot lb. feet lb. sh. d. $\frac{6}{10}$
1: '6:: 35,4: 21 04 09

'6

lb. 21' 24 3 0X0 6

20

)12|0(6
(0

sh. 4|8

12

d. 9|6

To do this decimally, * I reduce the 12 sh: into the decimal pts. of a pound, which is 6' 10. Then I multiply the 35'4 thereby, and the product is 21. lb. '24. Then I * reduce the '24: shill. and pennies; so there is in all 21. lb. 4 sh. 9 d. . for the 4th number, seeing the first is an unite * which divideth not. *5. Rule of Reduction. *5. Rule of Reduction. * Ax. 12.

To prove your work in this rule, in Fractions you may work as in Integers, if the opration was made decimall: If not, prove each Multiplication, as before is taught. Or you may work the whole operation by * inverse proportion, by saying, as the second to the first, so is the fourth to the third; or as the fourth to the 3d. so is the second to the first. * Ax. 22.

2. Rule called the Golden Rule, or Rule of three Reverse or backwards.

To work reverse, there needs no more,
But work with third, as first before.

The sence.

TO work the Golden Rule reverse, you need only observe to work with the third number as before you did with the first, in the forward Rule. That is to say; multiply the second number by the first, or the first by the second, (which is one and the same thing) and divide the product by the third, and the quotient will be the fourth number required.

Now for as much as in this Rule, the first is to the third, as the fourth is to the second: therefore by * Inverse proportion, the third shall be to the first, as the second to the fourth Required.

* *Eu.* 13 def. 5.

1. Example, *If* 100 *men do any piece of work in* 4 *dayes how many will do the same in* 20 *dayes*

d.	m.	d.	m.
4	100::	20:	20
	4		
20)400(20		2	4
00		4X4	
		1	2

Having found this question to be in the reverse Rule (by considering, that 20 dayes being a longer time then 4 dayes, must consequently require fewer men to work the same work) I multiplie the second 100 by the first 4. the product is 400. which I divide by 20. the third number, and the quotient is 20 for the fourth number required.

2. Exa

2. *Example. If a garrison be furnished with victuals at shall serve 120 men for 4 year, how long shall it serve 00 men?*

m.	y.	m.	y.
120 :	4 :	400 :	1 $\frac{1}{5}$

4   4   4

3 X 3

3   1

00)4|80 (1

80) 40|0 (5

0

To do this I multiply the first 120 by the second 4, and the product is 480. which I divide by the third 400. & the quotient is 1, 1'5 for he 4th (having * abreviated the fraction.)

* 2 Rule of Reduction.

3. Example. *I demand how many Ells of 5 quarter road will serve to line 48 ells of Cloath 6 quarter broad?*

. b.	ell l.	q. b.	ell l.
:	4 8 :	5 :	57 $\frac{3}{5}$

6   5   3

5)28 8 (57 $\frac{3}{5}$ 0 X 0

3(3   6   3

To do this, I multiply the second 48 by the first 6, the product is 288, which I divide by the third , and the quotient is 57 3'5 for the fourth number equired.

4. Example. *If 12 Inches in breadth of any plain superfice require 12 Inches in length to make a square foot, ow many Inches in length will another plain superfice equire, whose breadth is 22 Inches?*

Inches b.	In. l.	In. b.	In. l.
12 :	12 :	22 :	6 $\frac{6}{11}$

12

24   4   3

12   0 X 0

22)144 (6 $\frac{6}{11}$ 3   6

132

12

2) $\frac{6}{11}$

22

To do this I multiply the second 12 by the first 12 the product is 144 (the square inches in a superficial foot) which I divide by the third 22. and the quotient is 6 6'11 (*having abbreviated the fraction.)

* 2 Rule of Reduction.

2. Ex-

5. Example. *If the end of any Cube parallelopipidon, prism, or Cylinder, being 144 Inches in Superficial measure, do require 12 Inches of Length, to make a solid foot, how many will another require, whose base or end is 580 Inches of superficial measure?*

```
   In.    In. L.  In.  In. L.
   144 :  12 :: 580 : 2 142
    12                  145
   ----
   288
   144                 4     0
  ----
580)172|8(2            0 X 0
    116                3     2
    ---
    568 (284 (142
  2)---(---(---
    580  290  145
```

To do this, I multiplie the first 144. (the square Inches in a foot) by 12. the second, and the product is 1728. (the solid Inches in a solid foot) which I divide by the third 580. the quotient is 2,142'145. for the fourth * having abbreviated the fraction, and so of any other.

* 2. Rule of Reduction,

Examples of the *Golden Rule* Reverse in fractions.

1. Example. *I demand how much Lineing of 1'2. ell broad, will serve to line 3'4 ell of Cloath, being 5'8 ell broad?*

```
Ell.b. ell.l. ell.b. ell. l.
 5    3     1     15
---  :---  :: ---  :---
 8    4     2     16
 4           3
---          ---
32 D.        6
             5
            ---N.
      N.   30   15
      D.  2)---(---
            32  16
```

To do this, I multiplie the Denominator of the third 2 by 3 & 5 the Numerators of the second and first, for 30 the numerator of the fourth. Then I multiplie 8. the Denominator of the first, by 4. the Denominator of the second; the product is 32 for the Denominator of the fourth, * seing an unite the Numerator of the third Multiplieth not.

* Ax. 12.

2. Exam-

2. Example. *If my friend lend me* 358 lb. 15 sh. *for* 2,3'4 *year*; *how long must I lend him* 534 lb. 17 sh. *to requite the former courtesie?*

lb. years lb.

358 2 534

20 4 20

7160 8 10680

15 3 17

7175 : 11 : : 10697 : 15785/8545 or 1 7241/8544 years

20 4 20

4 11 2

80 220 4X4

10697 8 7175 2

855760 4X4 1100 4

5 1540 8X8

D. 220 2

1540 N. (1 72374/85576

855760)1578500(85576

72374

85576

To do this, I * reduce the first and third to shillings and the second to quarters of a year; and so work according to the Rule, as in the first Example: and finds 1 72374/85576 year * being reduced to an Integer & proper fraction.

* 5. Rule of Reduction.

* 4. Rule of Reduction.

This Question may be wrought with greater ease decimally, thus

lb. years lb. years

358'75 : : 2'75 : : 534'85 : 1'84 4877/10697

2'75

179375

25112 5

71750 (1.84 4877/10697

534'85)986'5625

53485.

451712

427880

23832 5

213940

24385

7 1

5X5

5 4

5)24385/53485(4877/10697

To do this, I reduce the fractions to decimal pts. either by the 5. Rule, or by a Table fit for the same; and so work, as before in Integers.

To prove your work in this Rule, take the third number for the first, in the forward Rule, and prove your work, as in the forward Rule is taught.

3. Rule

3. Rule called the Compound Rule, or double Rule of three in five Numbers,

FOR Compound, either back or fore,
Thus multiplie for Diviſore.
If fore, firſt two; with back diſjunct:
If back, Laſt two; with fore conjunct:
For dividend the other three
In Quotient the ſixth will be.

The ſence.

Generall Rule of Proportion.

TO work any opperation in the Compound Rule having firſt * placed your Number, as before taught, and likewiſe having tryed of what Rules it componded of, by ſaying, as the firſt to the third, is the fourth to another; and as the ſecond to that oth ſo is the fifth to the ſixth. and if both the operatio be of the forward Rule, multiplie the firſt two for D viſor. If the firſt be of the forward Rule, and the oth of the Reverſe Rule, multiplie the two which are d junct to the midle part or third number; that is to ſ the firſt and laſt for Diviſore. If both be of the Reve Rule, multiply the two laſt for Diviſor. If the firſt of the Reverſe Rule, and the ſecond of the direct Rul multiplie the two which are conjunct to the mi part; that is the ſecond and fourth for Diviſor. Th multiplie the other three which remains, for the D vidend; and ſo divide the Dividend by the Diviſor, a the Quotient will be the ſixth number Required:

1. Exa

1. Example. *Suppose it be required to find the interest of 635 lb. for 8 months, at 6 per cent p. annum.* *Set thus

lb. pr. m. lb. In. lb. pr. m. lb. sh. In.

100 : 12 : 6 :: 635 : 8 : 25 8

12 6

1200 581|0

8

1200)304|80(25

24

64 7

60 6X6

3

480

20 sh.

9600(8

9600

000

To do this I multiplie the first 100 by the second 12. for Divisor 1200. then I multiplie the fourth 635 by the third 6. & the product thereof 3810. by the fifth 8. & the last product 30480. is the dividend, which divided by the divisor 1200. the quotient is 25 lb. 8. sh. having reduced the fraction 480'1200.

* to shillings.

* Note that, although the moneths were put in the first & fourth place, and the pounds principal in the second and fifth, the work would be the same as it is now.

2. Example. *Suppose 30 men work 50 rood of work in 4 dayes, how many rood will 10 men work in 20 dayes at that rate.*

m. d. R. m. d. R.

30 : 4 : 50 :: 10 : 20 : 83 1/3

4 10

120 500

20

120)1000|0(83 1/3

96

40

36

4

4)—(1/3

12

To do this, I multiply the first & second for the divisor, and the other three for the dividend, then I divide as before, and the quotient is 83, 1'3. for the sixth having * abreviated the fraction.

2 X 1

3 3

* 5 Rule of Reduction.

* 2 Rule of Reduction.

3. Exam-

3. *Example.* *If* 100. *men ſpend* 1240. *bolls of victual, in two year; how much will* 250. *men ſpend in* 8 *moneths?*

men mo. bolls men m. bolls

100 : 24 : 1240 :: 250 : 8 : 1033 1/3

To do this, * I reduce the 2 years to moneths, and work as before; and finds 1033 1'3 bolls for the ſixth number, the * fraction beingabbreviated.

* 5. *Rule of Reduction.*

24 250

2400 62000
248
310000
8

* 2. *Rule of Reduction.*

2400)2480000(1033 1/3

24
080
72
80
72
8 1/3
8) 24 1/3

7
5 X 5
6

4. Example: *If* 3 *Cannons ſpend* 432 lb. *of pouder, at* 8. *ſhot; how much will* 5 *Cannons ſpend at* 15 *ſhot?*

Can. ſh. lb. Can. ſh. lb.

3 : 8 : 432 :: 5 : 15 : 1350

To do this, it is to be conſidered, that if 3. Cannons ſpend 432. lb. of pouder, 5. Cannons will ſpend more, and if 5 Can. ſpend more in 8 ſhots, that they will ſpend much more at 15 ſhot: which ſhows it to be compounded of the Golden Rule forwards. Therefore I work, as before, and finds the ſixth to be 1350. lb. of pouder required.

8 5

24 2160
15

10800
2160

24)32400(1350
24
84
72
120
120
000

0
0 X 0
6

Exam-

Examples of the compound Golden-Rule forwards in Fractions.

1. Ex. *If* 1'2 *Ell of Cloath of* 3'4. *Ell broad, cost a merk, what shall* 7'8 *Ell of* 5'8 *Ell broad cost at that rate?*

Ell. L. Ell. b - lb : Ell. L - Ell. b - lb.

1 : 3 : 2 : 7 : 5 : 35
2 : 4 : 3 : 8 : 8 : 36

2 4 3 8 8 36
2 3
8 64
2 3
16 192
7 3
112 D. 576
5
N. 560 (280 (140 (70 (35
2) 576 288 144 72 36

To do this, I multiplie the Denomintor of the second 4, and first 2. with the Numerator of the third 2, fourth 7, and fifth 5 for the Numerator of the sixth 560. Then I multiplie the Denominator of the fifth 8. fourth 8. and third 3. with the Numerator of the second 3. (but the Numerator of the first is an unite; * which multiplieth not) for the Denominator of the sixth 576. So is the sixth 35'36 * being abbreviated. *Ax. 12.

2. Exa. *If* 20. *men work* 35,3'4 R. *in* 63,1'2. D. *how many Roods will* 12. *men work in* 10 *dayes and a half?* * 2. *Rule of Reduction.*

m. d. R. : m. d. R.
20 : 63'5 : 35'75 :: 12 : 10'5 : 3'54 87/127

20 12
1270'0 210
105
126'0
35'75
6300
8820
6300
3780
4504'500

To do this, decimally, I multiplie the second 63'5. by the first 20. for the divisor. Then I multiplie the fifth 10'5. by the fourth 12. and the product thereof 126'0. by the third 35'75. & the last product

1270.0)4504.5|00 (3.54 87
381 127
0694
635
595
508
87 |00
127 |00

product is the dividend, which divided by the divisor (according to the Rule of division in decimal fractions) and the quotient is 3.54 87'127 for the sixth required.

Examples of the Componed Golden Rule, forward and reverse.

1. *Example*, If 1350 lb. of powder serve 5 Cannons, to 5 Shot, how many Cannons will 432 pound of powder serve 8 shot at that Rate?

pounds sh. Cann pounds sh. Ca.
1350 : 15 : 5 :: 432 : 8 : 3
8 5
10800 2160
15 3
10800 X
2160
10800)32400 (3
324
000

TO do this, I multiply the first 1350 by the fifth 8. being disjunct to the midle part, the product is 10800 for the Divisor, then I multiply the other 3. to wit the fourth 432 by the third 5. and the product thereof 2160. by the second 15, and the last product is 32400. which divided by the Divisor, the quotient is 3 for the sixth number required.

2. Exam-

2. Example, *If* 15. *men work* 25 *Rood of work in* 145 *dayes, how many men will work* 16 *Rood in* 14 *dayes?*

R.	D.	m.	R	D.	m.
25 :	145 :	15 : :	16 :	14 :	$99\frac{3}{7}$

```
 14                  15
----                ----
100                  80
25                   16
----                ----
350                 240      6X6
                    145       2
                   ----
                   1200
                    960
                    240
                   ----
          350)3480|0 (99 3/7
              315
              ----
               330
               315
               ----
                15|0
          5)-------(3/7
               35|0
```

TO do this, I multiply the first 25 by the fifth 14 (being the extreems of that which is given and disjunct to the midle point as before) the product is 350 for the divisor, then I multiply the other three for the dividend, and so divideth, and the quotient is 99, 3'7 *(the fraction being abreviated.)

*2 Rule of Reduction.

Exam-

Example of the Compound *Golden Rule* forward, and reverse in Fractions.

1. Example. *If* 7'8. *Ell of Cloath of* 5'8. *Ell broad coſt* 35'36. lb. *how much will I get of* 3'4. *broad for a mark?*

lb.	Ell.b.	Ell.l.	lb.	Ell.b.	Ell.l.
35	5	7	2	3	1
36	8	8	3	4	2
4			8		
144			24		
5			8		
720			192		
7			3		
5040			576		
2			35		
10080			2880		
10080) 20160 (1/2			1728		
			20160		

TO do this, I multiplie the Denominators of firſt 36, and fifth 4, with the Numerators of the ſecond 5, third 7, and fourth 2, for the Numerator of the ſixth 10080. Then I Multiplie the Denominators of the fourth 3, third 8, and ſecond 8, with the Numerators of the fifth 3, and firſt 35 for the Denominator of the ſixth 20160, ſo is the ſixth 1'2 (* being abbreviated).

* 2 *Rule of Reduction.*

2. *Exam-*

2. Example. *If I recive* 36 lb. 10 sh. *Interest for* 8 12. *moneth, at* 6. per Cent per annum, *what is the principal summe?*

lb. J. m. lb. p. lb. J. m. lb. p. d.

6 : 12 : 100 :: 36'5 : 8'5 : 858. 16. 5 $\frac{11}{17}$

8'5
100
51'0 3650'0
12
73000
36500
lb. sh. d.
51.0) 43800'0 (858. 16. 5 $\frac{11}{17}$
408
300
255
450 3
408 6 X 6
6
42
20
shill.) 840 (16
51
330
306
24
12
48
24
pennies) 288 (5
255
33
3) (11
51 17

To do this decimally, I multiplie the first 6 by the fifth 8'5. for the Divisor 51'0. Then I multiplie the fourth 36'5 by the thrid 100, and the Product thereof 3650'0 by the the second 12 and the last Product is 43800'0. for the Dividend; and by dividing I find the quotient to be 858 lb. 16 sh 5 d. 11'17: the * fraction being reduced to sh. and pennies.

* 5 *Rule of Reduction.*

Exami-

Examples of the Compond Golden Rule Reverse.

1. *Example. If 12 Inches in Breadth, and 12 Inches in thickness Require 12 Inches in length to make a solid foot, what length will 6 Inches in breadth and 4 Inches in thickness require?*

```
In. b. In.th. In.l.  In.b. In.th. In.l.
 12 : 12 : 12 : : 6 : 4 : 72
          12          6
          ---        ---
          24         24
          12
          ---
          144
           12        o
          ---       oXo
          288        6
          144
          ---
     24) 1728 (72
         168
         ---
         048
          48
         ---
          00
```

To do this, I multiply the fifth 4 by the fourth 6 (being the last two) for the Divisor 24. Then I multiplie the third 12 by the second 12 and the product thereof 144 by the first 12. and the last product is 1728 (being the solid Inches in a solid foot) and so dividing as before the quotient is 72. for six number required.

2. *Exam-*

2. Example. *If 1 Ell in breadth and 1 Ell in thickneſs require 36 Ell in length to make a Rood of work, what will 3 Ell in breadth and 2 Ell in thickneſs require?*

Ell b. Ell th. Ell l. Ell b. Ell th. Ell l.
1 : 1 : 36 :: 3 : 2 : 6

$\frac{3}{6}$

6) 36 (6
0

To do this, I multiply the fifth 2. by the fourth 3. for the Diviſor 6. and ſeing the firſt and ſecond are unites, (*which multiplieth not) the third 36 is the dividend. So is the quotient 6 for the ſixth number required. * Ax. 12

Examples of the Compound Golden-Rule reverſe, in Fractions.

1. Example. *Suppoſe there be a peice of Timber 3'4 foot long, 2'3 foot broad, 2'5 foot thick, and that I would have an other peice equal thereto in magnitude, that ſhall be 5'7 foot long, and 3'5 foot broad; I demand how thick it ought to be?*

l. b. th. l. b. th.
3 . 2 . 2 . . 5 . 3 . 7 .
4 . 3 . 5 . . 7 . 5 . 15

3 — 7
15 — 35
4 — 2
60 — 70
5 — 2
300 — 140
3 — 3
900 — 420 | 0 — 7/15
6)
90 | 0
3 | 0

To to this, I multiply the Denominator of the fifth 5. and fourth 7. with the Numerators of the third 2. ſecond 2. and firſt 3. for the Numerator of the ſixth 420. Then I multiply the Denominators of the third 5. ſecond 3. and firſt 4. with the Numerators of the fourth 5. and fifth 3. for th Denominator of the ſixth 900. ſo is the ſixth 7'15 (*being abreviated.) * 2 Rule of Reduction.

2. Example. *Suppose there be a peice of Timber 2'5 foot thick, 5 1'2 foot long, and 3'4 foot broad. and that I would have another equal thereto in magnitude, whose thickness is 1'4 and, length 3 1'5 foot, I demand the bread thereof?*

th. l. b. th. l. b.
'4 : 5'5 : '7 5 : : '25 : 3'2 : 2'05
5'5 '25 8
375 160
375 64
4'125 '8 00
4
'800) 1'65|00(2'05 2
0(5 8 3X3
8 20, 5'8

To do this decimaly, I multiply the two last for the Divisor, and the three first for the Dividend, and so divides according to the decimal way in division, and so finds quotient for the sixth required.

Examples of the Compound Golden Rule reverse, and forwards.

1. * Example. *If 15 shot of 5 Cannons spend 1350 lb. of Pouder, how many Cannons will spend 432 lb. at 8 shot?*

* *Not that the Examples of this kind, is the same with those of the second kind, except in placing of the numbers.*

sh. lb. can. sh. lb. cans.
15 : 1350 : 5 : : 8 : 432 : 3
8 15
10800 2160
432
6480
5
10800)324|00(3
324
000

To do this, I multiply the second 1350. by the fourth (being conjunct to the midle part) for the Divisor 10800. Then I multiply the fifth 432. by the first 15. and the product thereof 6480. by the third 5. and the last Product is 32400. for the Dividend, and so dividing I find the quotient 3. for the sixth Number required.

2. Example. *If* 15. *men work* 25. *Rood of work in* 145. *dayes, How many men will work* 16. *Rood in* 14 *dayes.*

d	R.	m.	d:	R.	m.
145 :	25 :	15	14 :	16 :	99 3/7
	14			15	
	100			80	
	25			16	0
	350			240	5X6
				145	8
				1200	
				960	
				240	
			350)	3480	99 3/7
				315	
				330	
				315	
				150	
			5)	350	(3/7

To do this I multiply, and divide according to the Rule, and finds the quotient to be 99. 3'7 men which 3'7 of a man, is understood to be on man to work the 3'7 of a day.

Examples of the Compound Golden-Rule reverſe and forwards, in Fractions.

1. Example. *If 7 8 Ell of Cloath of 5 8 Ell broad coſt 35 36 lb, how much will I get of 3 4 broad for a mark?*

Ell b.	lb.	ell l.	ell b.	lb.	ell l.
5	35	7	3	2	1
8	36	8	4	3	21
	4			8	
	144			24	
	51			8	
	720			192	
	7			3	
	5040			576	
	2			35	
	10080			2880	
10080)		(1/2		1728	
	20160			2016|0	

To do this, I multiply the Denominators of the ſecond 36. and fourth 4. with the Numerators of the firſt 5. third 7. and fifth 2. for the Numerator of the ſixth 10080. Then I multiply the Denominators of the fifth 3. third 8. and firſt 8. with the Numerators of the fourth 3. and ſecond 35. for the Denominator of the ſixth 20160. ſo is the ſixth 1'2 (* being abreviated.)

*2 Rule of Reduction.

2. Exam-

2. Example. *If I receive* 3 lb. 8 shill. *interest for* 8 1'2 *moneths, at* 6 per cent. per annum, *what is the principal summe?*

```
m. lb.in. lb.pr.  m.  lb.in.  lb.pr.
12 : 6 : 100 :: 8'5 : 3'4 : 80
  8'5                100
  ---               ----
 51'0               340'0      8
                      12     3X3
                    ----      6
                    6800
                   3400
                   ----------- lb.pr.
            51'0)4080|0(80
                 408
                 ---
                  00
```

To do this decimaly, I multiply and divide according to the Rule in decimal fractions, and the quotient is 80 lb. for the sixth number required.

To prove your work in this Rule, in Integers, or Decimal fractions; cast away the nins from the quotient, Noting the Remainders; Then cast away the nines from that two which makes the divisor, and multiplie the remainders thereof, and cast away the nines from that product, and multiply the remainders by the remainders that was noted of the quotient, and cast away the nines from that product, together with the remainers of your division, and set down the remainders thereof; then cast away the nines from these three that makes the dividend, and multiply the remainders into other, and cast away the nines from the last product, and if the remainers thereof be equal to that which was set down, you have wrought right, otherwise not.

CHAP. III. *Fellowſhip.*

Fellowſhip, or Partenerſhip is when there are two or more parties in fellowſhip, or company, and that there is given a certain ſumme of money or other things to be allowed proportionally amongſt them, to find out each parties ſhare thereof.

1. Rule, called the ſingle Rule of Fellowſhip.

For Fellowſhip, your work muſt be
By Golden Rule, for each partie,
As whole, to that which given are
So is each part, to its own ſhare.

The Senſe.

To work the rule of Fellowſhip, you muſt make an operation of the Golden-rule, for each party. Thus, as the whole (which is the ſumme belonging to all the parties) to that ſumme which is given to be diſtribut amongſt the parties, ſo is each part of the whole given, to its ſhare of the ſumme given to be diſtribute amongſt the parties.

1. Example. *If four parties A, B, C, and D. laid in* 5000 lb. *in ſtock of which A. laid in a* 100 lb. *B.* 600 lb. *C.* 1300 lb. *and D.* 3000 lb. *and that they had gained* 1000 lb. *upon the whole, what muſt each have thereof?*

To

lb.

lb. lb.
5000 : 1000 : :

100 : 20
600 : 120
1300 : 260
3000 : 600

5000 : 1000

500) 100|000(20
00
500) 600|000(120
000
500) 130|000(260
300
500) 3000|000(600
000

To do this, I first add up all the parts, and the summe is 5000 lb. then I say, if the said summe 5000 lb. yeald 1000 lb. of again, what will each of it parts yeald? so have I 20. lb. for A. 120. for B. 260. for C. and 600 lb. for D. which was required.

2. Example. *If three parties* A. B. C. *lay in a Stock of* 3650. lb. *of which* A. *layeth in* 340. lb. B. 1500 lb. *and* C. 1810. lb. *and that they loss* 100. lb. *what must each man bear of the losse?*

lb. lb. sh. d.

lb. lb.
3650 : 100 : :

340 : 9-06- 3,45
1500 : 41-01-11, 01
1810 : 49-11-09, 27

3650 : 100.00.00

73

365|0 3400|0(9
3285
115
20
sh.
)2300(6
2190
110
12
220
110
d.
)1320(3
1095
225
5)——(45/73
365

```
                lb.                                  lb.
365|0 )15000|0 (41          365|0 ) 18100|0 (49
       1460                         1460
       ----                         ----
       0400                         3500
        365                         3285
       ----                         ----
         35                          215
         20                           20
       ----  sh.                    ----  sh.
       )700 (1                     )4300 (11
        365                         365
       ----                         ----
        335                          650
         12                          365
       ----                         ----
        670                          285
        335                           12
       ----  d.                     ----
       )4020(11                      570
        365                          285
       ----                         ----
        370                        )3420(9
        365                         3285
       ----                         ----
         05                          135
   5 )----(1/73                5 )----(27/73
        365                         365
```

To do this, I say by the Golden Rule as the whole 3600lb. to the summ lost 100 lb. so is each of the summs laid into their portions of the loss, so that A. hath 9 lb. 6 sh. 3 d. 45'73 of a penny of the loss, and B. 41 lb. 01 sh. 11. d. 1'73 of a penny, and C. 49. lb. 11. sh. 9 d. 27'73 of a penny, as in the work.

3, Exam-

3. *Example. Two parties A. and B. lay in a stock of* 2000 lb. *of which A. layeth in* 1500. *and B.* 500 lb. *and having gained* 650 lb. *and lossed* 50 lb. *what must each have at their parting?*

Whole Stock	2000			
Gain . . .	650			
The Summe .	2650	lb.		lb.
Loss Substract .	50	1500	:	1950
2000 :	2600::	500	:	650
		2000	:	2600

2

1500	2600
2600	500
2) 3900|000(1950	2) 1300|000(650
110(0	10(0

Examples of Fellowship in Fractions.

1. Example. *Two men A. and B. are Partners of a Ship, whereof A. hath* 1'3, *and B.* 2'3, *and having gained* 1590 lb. *I demand what must each Partner have?*

		N.		lb.
D.	lb.	1	:	530
3.	1590 ::	2	:	1060
		3	:	1590

3) 1590(530
00(0 2
1060

TO do this (seing both Fractions are of one Denomination,) I take the common Denominator 3 for the whole, and takes the Numerators 1. and 2. for the parts, and so worketh as in Integers; observing that

that for the 1. operation, I only divide the second number by the first, seing the third is an unite * which multiply not) Then for the second operation I double that which the first gives, seing the numerator of the second is double to that of the first.

*Ax. 12.

2. Example. *Three-men A. B. and C. are Partners of* 400. lb. *whereof A. hath* 3'8. *B.* 2'5. *I demand the portions of A. and B. and what remaineth to* C?

D.	N.	lb.
8	3	150
400 ::		
5	2	160

Summe of A. and B: 310
Summe of all . . 400
Rests for C. . . 090

400
3
lb.
8)1200(150
40(0
400
2
lb.
5)800(160
30(0

To do this, I take each denominator given for the whole to its own Numerator, and so works as before for the portions of A. and B. and substracteth their summe from the given summe to be devided; and the remainders is the portion belonging to C.

3. Example. *five brethren* A. B. C. D. *and* E. *having a Legacy of* 10080 lb. *to be divided, so that* A. *is to have* 1'2. B. 1'4. C. 1'8. D. 1'12. *and* E. 1'24. *But* C. *dying before the parting thereof, leaveth his share to be divided proportionally amongst his Brethren, I demand the share of each?*

A. -	1152	1' 2	2
B. -	576	1' 4	4
D. -	192	1' 12	8
E. -	96	1' 24	12
Summe	2016		96

2304

96
24
384
192
2304

2) 2304 (1152.
010(0

12) 2304 (192
12.
110
108
24
24
00

4) 2304 (576
32 0

24) 2304 (96
216.
144
144
00

2016: 10080 :: { 1152: 5760 A. / 576: 2880 B. / 192: 960 D. / 96: 480 E. } 2016

2016: 10080

10080
1152
20160
5040
1008
1008
2016) 11612160 (5760
10080
15321
14112
12096
12096
000

2) 5760 (2880
110(0

6) 5760 (960
30(0

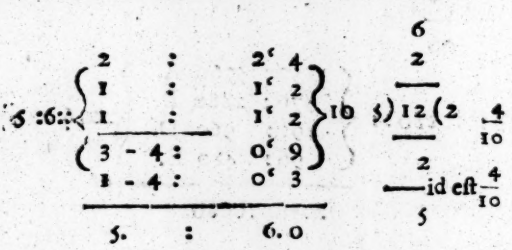
2) 960 (480
10(0

To

*3 Rule of Reduction.

To do this, I first * reduce all the fractions (Except that which belongeth to C.) to on denomination, and taketh the ſumme of the numerators for the whole, and ſo worketh firſt for the portion of A. 5760. and taketh the 1'2 thereof 2880 for B (ſeing 1'4 is the 1'2 of 1'2) and the 1'6 thereof. 960 for D (ſeing 1'12 is the 1'6 of 1'2) and the 1'2 of that which belongeth to D. 480 for E (ſeing 1'24 is the 1'2 of 1'12) ſo have I the portion of each, as was required.

4. Example, *five partners have taken five Horſe gang of a quarter Land, (on going of to an other quarter Land) whereof the firſt hath 2. horſe gang, the ſecond 1. and the third 1. the fourth 3 feet (or 3'4 of a horſe gang) the fifth 1 foot (or 1'4 of a Horſe gang) Now they being to yoke a ſix Horſe plough; I demand what order they ſhall keep in puting their Horſe in the plough?*



To do this, I ſay firſt if 5 horſes yeald 6. horſes what will 2. horſes yeald? Anſwer. 2 Horſes 2'5, which is '4 (being a more convenient fraction) which is as much as to put in an other Horſe 4. dayes each 10. dayes; then ſeing the ſecond and third hath but 1 horſe they muſt put in but the half of that which the firſt put in, which is 1 Horſe' 2. that is, a Horſe every day in the plough, and an other 2 dayes each 10 dayes: Nixt for the fourth which muſt put in 3'4 of that which the ſecond, and third put in, which is '9 (being 3'4 of 1'2) that is to put in a Horſe 9 dayes each 10 dayes,

and

and the laſt muſt put a Horſe in 3 dayes, each 10 dayes. Note, that this Example fell realy out, and was put to me, in the year 1679. when I taught in the Pariſh of *Balriſhean*; which is in the Barrony of *Dunluce*, and County of *Antrim* in *Ireland*; for which Cauſe I have Inſert the meaſures of that Kindom.

To prove your work in this Rule, ſumme the parts, and likewiſe their portions; and if the ſumme of the parts* be equal to the whole, and the ſumme of the portions equal to the given ſumme, you have wrought right, otherwiſe not. * Ax 4.

Note, that if any queſtion be proponded, which hath not the parts equal to the whole, it is improper and ill proponded by the 4. Ax.

2. Rule Called the Rule of Fellowſhip Compound.

IF Fellowſhip Compounded be,
Each part with Compound multiply;
Take products ſumme, for whole before,
Products for parts, but change no more.

The ſence.

TO work the Rule of Fellowſhip Compound, multiply each part by that wherewith it is compounded; Then ſumme the products, and take the ſumme thereof in ſtead of the whole in ſimple Fellowſhip, and each product for the part whereof it is made, and keeping the given ſumme as before, work as in ſimple fellowſhip; that is, as the ſumme of the products to the given ſumme, ſo is the product made of any part, to the portion of that part, required.

1. Exam-

1. Example, If four parties A. B. C. and D. lay in a stock of 500 lb. whereof A. layeth in 200 lb. for one years, B. 180 lb. for two years, C. 80 lb. for three year, and D. 40 lb. for four years, and having in the end gained 600 lb. what must each have thereof?

lb.

$$\left.\begin{array}{l} 200 \times 1 = 200 \\ 180 \times 2 = 360 \\ 80 \times 3 = 240 \\ 40 \times 4 = 160 \end{array}\right\} 960 : 600 :: \left\{\begin{array}{l} 200 : 125 \\ 360 : 225 \\ 240 : 150 \\ 160 : 100 \end{array}\right\}$$

lb.

Summa 960 — 960 : 600

```
        200                    360
        600                    600
        ---------  lb.        ---------  lb.
960) 12000|0 (125      960) 21600|0 (225
     96..                   192
     ---                    ---
     240                    240
     192                    192
     ---                    ---
      480                    480
      480                    480
      ---                    ---
      000                    000
      ---                    ---

        240                    160
        600                    600
        ---------  lb        ---------  lb.
960) 14400|0 (150      960) 9600|0 (100
     96..                   96...
     ---                    ---
      480                    000
      480                    ---
      ---
      0000
```

2. Exam-

2. Example. *Suppose I have 25 Ells of Cloath at* 3. lb. *the Ell*, 36. *Ells at* 5 lb. *the Ell*, *and* 45. *Ells at* 6. lb. *the Ell*, *and that I sell the whole for* 655. *I demand what I gained upon each sort?*

lb.	lb.		lb.	lb.
25 x 3 =	75		75:	20
36 x 5 =	180	525: 140::	180:	48
45 x 6 =	280		270:	72

Price of all 525 : 525: 140.
Price, & gain 665

The whole g. 140	140	140
75	180	270
700	11200	9800
980	14	28
lb.	lb.	lb.
525)10500(20	525)25200(48	525)37800(72
1050.	2100.	3675
0000	4200	1050
	4200	1050
	000	000

3. Example. *Suppose there is a booty of* 3878. lb. *to be divided proportionally amongst an Army of* 1000. *foot*, *at* 8. sh. *the day each man*, *and* 300 *Horse-men*, *at* 18 sh. *the day each Horse-man*, *what must the Foot-men*, *and what must the Horse-men have thereof?*

lb.	sh.		lb.	sh.	d.	
1000 x 8 =	8000		8000:	2315.	04.	05.49
300 x 18 =	5400	13400: 3878::	5400:	1562,	15.	06.18
	13400		13400:	3878.	00.	00

3878
8000
lb.
13400) 310240 | 00 (2315
268..
422
402
204
134
700
670
30
20
fh.
) 600 (4
536
64
12
128
64
d.
) 768 (5
670
98
2) (49/67
134

3878
5400
1551200
19390
lb.
13400) 209412 | 00 (1562
134..
754
670
841
804
372
268
104
20
fh.
) 2080 (15
134
740
670
70
12
d.
) 840 (6
804
36
2) (18/67
134

Exam-

Examples of Fellowship compound in Fractions.

1. Example, *If two men* A & B *lay in a Stock, so that* A. *layeth in* 2'5 *for* 1'4 *of a year, and* B. 3'5 *for* 3'4 *of a year, and having in the end* 445 lb. 10 sh. *of Stock, what must each have thereof?*

A	B.		
N D	N D		
2' 5	3' 5	lb.	2: 81 lb.
1' 4	3' 4	11: 445, 1'2 ::	9: 364, 1'2
2'20	9'20		11: 445, 1'2
9'20			
11'20			

```
   445, 1'2                445, 1'2
      2                       9
   ---                     ----
11)891(81               11)4009, 1'2(364, 1'2
   88.                     33
   ---                     ---
    11                      70
    11                      66
    ---                     ---
     00                      49
                             44
                             ---
                              5, 1'2
                         5,1'2 ----(1'2
                             11
```

To do this, I multiply each party with its compound, and seing the products are of one denomination, I add them, and so worketh with the Numerators as before with the Integers.

2. Example. *If three men, A. B. and C. lay in a Stock, whereof A. layeth in 1'3 for 3'5 of a year, B layeth in 2'5 for 3'7 of a year, and C. layeth in 4'15 for 3'4 of a year, and having gained in the end 386 lb. I demand what each muſt have thereof?*

	N.	D.
A.	1'	3
	3'	5
	3'	15

	N.	D.
B.	2'	5
	3'	7
	6'	35

	N.	D.
C.	4'	15
	3'	4
	12,	60

N.		
6300	3' 15	} 31500
5400	6' 35	
6300	12' 60	
18000		

15
35
75
45
525
60

15) 31500 (2100
30 3
15 | 6300
15
0000

35) 31500 (900
315 6
0000 | 5400

60) 315 | 0 (525
13(0 12
1050
525
6300

18000 : 386 : : { 6300 : 135 . 02 / 5400 : 115 . 16 / 6300 : 135 . 02 }

lb.	ſh.
18000 :	386 . 00

```
        386                          386
         6300                        5400
       ------                      ------
       115800                      154400
       2316                        1930
       ------                      ------
                lb.
18000) 2431|800(135'1   18000) 2084|400(115'8
       18          2            18          2
       --          --           --          --
        63         2 sh.        28         16 sh.
        54                      18
        --                      --
         91                     104
         90                      90
         --                      --
          18                     144
          18                     144
          ----                   ----
          0000                   0000
```

To do this, I multiplie each party with its compound as before, and reduceth the products to one Denomination, and so worketh with the Numerators as before.

3. Example. *If I mix* 5, 1'2 *bolles of Oats at* 4 lb. 10 sh. *the Bolle*, 4 *Bolles* 3 *Firlets of Bear at* 6 lb. 16 sh. *the Bolle*, 6 *Bolles and one Firlet of Pease at* 5 lb. 6 sh. *the Bolle*, 7 *Bolles and one Firlet of Wheat at* 6 lb. 12 sh. *the Bolle*, *and having sold the whole for* 200 lb. *I demand how much I gained upon each sort?*

```
 bolls    lb.
 5'50 x 4'5  =  24'750 }
 4'75 x 6'8  =  32'300 }
 6'25 x 5'3  =  33'125 }
 7'25 x 6'6  =  47'850 }
                ------
                138'025
```

lb. sh. d.

138'025:200:: { 24'750:35.17.3: 18825 / 32'300:46.16.0.103200 / 33'125:47.19.11.90025 / 47'850:69.6.8.64000 } 138'025

138'025:200.00.0.00000

24'750
200
138'025) 4950'000 (35.17.3 lb. sh. d.
414075.
809250
690125
119125
20
)2382500(17 sh.
138025
1002250
966175
036075
12
72150
36075
)432900(3 d.
414075
18825

32'300
200
138'025)6460'000(46.16.00 lb. sh. d.
552100
939000
828150
110850
20
)2217000(16 sh.
138025
836750
828150
08600
12
17200
2600
)103200(0 d.

33'125

83'125
200
lb. ſh. d.
138'025) 6625.000 (47. 19. 11
5521 00
1104000
966 175
137825
20
)2756500 (19 ſh.
138025
1376250
1242225
134025
12
268050
134025
)1608300 (11 d.
138025
228050
138025
90025

47'850
200
lb. ſh. d.
138'025)9570000(69. 6. 8
828150
1288500
1242225
46275
20
)925500(6 ſh.
828150
097350
12
194700
97350
)1168200(8 d.
1104200
64000

*Prove this Rule the ſame way as Simple Fellowſhip. *Ax. 4.

CHAP. IV. Medial.

Medial, is when diverſe parties are given, to finde a mean reſulting amongſt them.

---

1. Rule, called the Medial Rule ſimple.

For Medial ſimple, this will guide;
By places ſumme you muſt divide
The tottal ſumme, if of one kinde:
If divers, each ſumme that you finde:
If contrary, ſummes difference:
Quotient is mean, as in the ſenſe.

The ſenſe.

TO work the Medial Rule ſimple, you muſt take the ſumme of the places for your Diviſor, then if all the ſimples be of one kind, take their ſumme for the Dividend; but if they be of divers kinds, take the ſumme of each kind ſeverally, (both of the places and content) to find the mean belonging to each of the kinds: But if any of them be of contrary Denominations, take the difference of their ſummes for the dividend,

dend, and the ſumme of both their places for the diviſor; divide, and the quotient will be the mean Reſulting.

1. Example. *Suppoſe there be mixed equally wheat at* 8 ſh. *the peck,* Ry *at* 6 ſh. *the peck, oats at* 5 ſh. *the peck, and bear at* 4 ſh. *the Peck, what is the Peck of this mixture worth?*

8 5
6 5X5
5 4
4
4)23 (5 3/4
(3

To do this, I add the prices * given, and the ſumme is 23, which I divide by the Number of the places 4, and the quotient is 5, 3'4 for the mean price required.

2. Example. *Suppoſe a mint Maſter mix equally Gold, at* 22, 21, *and* 19. *Carects fine, what finneſs is this mixture?*

22 2
21 8X8
19 3
3)62(20 2/3
0(2

To do this, I work with the ſeveral kinds given, as before with the prices, and finds the finneſs of the whole to be 20 2'3 Careets required.

2. Example. *Suppoſe an Apothecary mix equally theſe ſimples following,* viz. A. 3 d. *hot.* B. 1 d, C. 2 d, *and* D. 1 d. *hot;* E. 2 d. *dry,* F. 3 d. *and* G. 3. d. *dry; I demand the form reſulting thereof?*

hot.
A. 3 d.
B. 1 1
C. 2 7X7
D. 1 4
4) 7 (1 3/4
(3

dry.
E. 2d. 2
F. 3 8X8
G. 3 3
3) 8(2 2/3
(2

To do this, ſeing they are of divers kinds, I find the mean of each kind as before, which is 1, 3'4 d, hot, and 2, 2'3 d dry, which was required.

4 Example. *Suppose an Apothecary mix equally these simples following*, viz. A. 2 d. *hot*, B. 2 d, C. 1 d, *and* D. 1 d. *hot*; E. 3 *d. cold*, F. 4 d. *and* G. 4 d. *cold*; H. 1 d. *moist*, I. 2. d, K. 1 d, *and* L. 1 d. *moist*. M. 3 d. *dry*, *and* K. 4 d. *dry*; *what is the form resulting thereof*?

hot.		cold.		moist.		dry.	
A	2 d.	E	3 d.	H	1 d.	M	3 d.
B	2	F	4	I	2	N	4
C	1	G	4	K	1		
D	1			L	1		7
	6		11		5		5
			6				2
			5 cold				2/6 or 1'3 dry
			7				

§ To do this, I first substract the sum of the degrees of heat 6, from the sum of the degrees of cold 11. (seing they are contrary) and the remainder is 5 to be divided by 7 (the Number of places in both) making the fraction 5'7 * cold, secondly I substract the sum of the degrees moist 5, from the sum of the degrees dry, 7. (seing they are likewise contrary) and the remainer is 2. to be devided by 6. (the number of places in both) making the fraction 2'6 which * abreviated is 1'3 * dry.

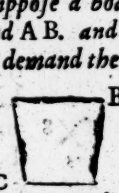
* Ax. 7.

* 2 *Rule of Reduction.*

* Ax. 7.

Examples of Medial in Fractions.

1 Example. *Snppose a board* A. B. C. D. 1'2 *foot broad at the one end* A B. *and declining to* 1'4 *foot at the other end* C. D; *I demand the mean breadth*?



* 3 *Rule of Reduction.*

4 | 1'2 } 8
2 | 1'4 }

2) 6 (3'8

To do this I * Reduce the fractions to one denomination, and addeth the numerators, and the the sum is 6. which I divide by the number of the places 2. and the quotient is 3'8 for the mean breadth required.

2. Exam-

2. Example. *Suppose a peice of Land* E F G H *be* 4'5 *full broad at the one end* E F, 1'5 *at the midle, and* 2'5 *at the other end* G H; *I demand what is the mean breadth?*

4' 5
1 5
1 ' 5
2 ' 5
4)8 (2'5
(0

To do this, seing they are of one Denomination, I work with the Numerators as before I did with Integers, (observing that such questions, as this in breadth, the midle breadth is still to be repeated twice, because they answer the superfice on each side of them) so is the mean 2'5 required.

3. Example. *Suppose there be a peice of Land* A. B. C. D. *whose breadth, at* A. B. *is* 12, 1'2 *falls, and descending from thence to* E. F. 9, 5'4 *falls, from thence ascending to* G. H. 15, 1'4 *falls, and from thence descending to the end* C. D. 6, 1'2 *falls; I demand the breadth?*

A B 12'50
E F 9'75
E F 9'75 2
G H 15'25 6X6
G H 15'25 6
C D 6'50

6) 69 (11, 1'2
0 (3
3)—(1'2
6

To do this decimally, * I reduce all the fractions to decimall fractions and work as before in Integers, (observing to repeat the midle breadths twice, as before) so is the mean breadth found 11, 1'2 falls which was required.

* 2. *Rule of Reduction.*

To prove your work in this Rule, cast away the nines from the quotient, and likewise from the divisor, and multiply their remainders, and cast away the nines from the product together, with the nines of the remainers, and not that remainers. Then cast away the nines from the parties, and if the remainders be equal to the remainders that was noted, you * have wrought right, otherwise not. If they be of divers kinds, prove each kind severally after the foregoing manner.

But

But if they be of contrary kinds, caſt away the nines from each kind ſeverally, and ſubſtract the remainer of the leſſer ſumme, from that of the greater (by adding nine if ſubſtraction cannot otherwiſe be made) and if the Remainers be equal to that which was noted of the Diviſor and Quotient, &c. you have wrought right, otherwiſe not.

---

2. Rule, called the Medial Rule compound.

FOR compound Medial, multiplie
Each compound with its own partie,
Take products now, for parts before.
Add ſumme of parts for diviſore.

The ſenſe.

To worke the Medial rule Compound, multiplie each partie with that wherewith it is Compounded, and ſo work with the products, as before you did with the ſimple parts, and take the ſumme of the parts Inſtead of the ſumme of the places before, and ſo work as before in ſimple Medial.

1. Example. *Suppoſe I have* 40. *ells of Cloath at* 3 lb. *the ell,* 20 *ells at* 5 lb. *the ell,* 30 *ell at* 6 lb. *the ell, and* 15. *ells at* 4 lb. *the ell, I demand the price of each ell, to ſell on ell with another?*

ell	lb.		
40 x 3 =	120		4
20 x 5 =	100		1 X 1
30 x 6 =	180		6
15 x 4 =	60		
		lb.	
105)	460	(4 $\frac{8}{21}$	
	420		
	40		
	5) 105	($\frac{8}{21}$	

To do this, I multiply each part with its compound, as the Rule directeth, and add the products. The summe is 460. for the dividend, likewise I add the parts, and the summe is 105 for the Divisor, by which I divide the Dividend 460. and the quotient is 4, 8'21 (*being abreviated) which is near 4 lb. 8 sh. for the mean price required. * 2. *Rule of Reduction.*

2. Example. *Suppose a Mint-master mix* 5 lb. *of Gold* 23 *Carects fine, with* 16 lb. *of* 22 *Carects fine, and* 33 lb. *of* 19 *Carects fine; I demand what fineness the whole mass will be?*

lb. car.		
5 x 23 =	115	2
16 x 22 =	352	5 X 5
33 x 19 =	627	2
54)	1094	(20 $\frac{7}{27}$
	108	
	14	
	2) 54	($\frac{7}{27}$

To do this, I multiply each wight by its finness and addeth the products, and the summe is 1094 for the dividend, and likewise I add the Parties, (*viz.* the weights) and the summe is 54 for the Divisor, by which I divide the dividend 1094. the quotient is 20, 7'27 (*being abreviated) for the finness of the mass reqnired. * 2. *Rule of Reduction.*

4. Fxample, *Suppose an Apothecary mix these simples following*, viz. A 4 ℥, 3 d. *Cold*, B 6 ℥, 2d. *Cold, with* C. 12 ℥ 1 d. *Moist, and* D. 8 ℥, 4 d. *moist; I demand the quality resulting?*

		℔. d.				℔. d.	
cold.	A	4 x 3 = 12	6 X 6	moist.	C	12 x 1 = 12	0 X 0
	B	6 x 2 = 12	1		D	8 x 4 = 32	2
		1 | 0)	2 | 4 (2'4			2 | 0)	44 (2'2
							0 (0

To do this, for as much as they are of divers kinds, I work each kind by it self as before, and finds the whole mass to be 2'4 cold and 2'1 moist required.

5 Example. *Suppose an Apothecary mix these simples following*, viz. A. 4℔, 3 d. *hot*, B. 1℔ 2 d. *and* C. 5℔, 4 d. *hot*; D 2℔, 3 d. *cold*, E. 15℔, 2 d, *and* F. 1 lb. 1℔ 1d. *cold*; G. 4℔, 4 d. *moist and* H. 6℔ 2 d. I. 1 lb. 3℔ 2 d. *dry*, K. 9℔, 3 d.. *and* L. 10℔, 4 d. *dry*, *I demand the quality Resulting?*

		℔. d.				℔. d.	
hot.	A	4 x 3 = 12	62	moist.	G	4 x 4 = 16	28
	B	15 x 2 = 30			H	6 x 2 = 12	
	C	5 x 4 = 20			I	19 x 2 = 38	105
cold.	D	2 x 3 = 6	33	dry.	K	9 x 3 = 27	
	E	5 x 2 = 10			L	10 x 4 = 40	
	F	17 x 1 = 17					
		48) dist. 29 (od 29/48 hot				48) dist. 77 (1 29/48 dry.	
						48	
						29.	

0 X 2 — 3

1 X 5 — 3

To find the quality resulting in contrary kinds as in this Example, I multiplie each quantity by its quality, as in the 4 Example, and substracteth the sum of the products, which cometh of the cold 33, from that which cometh of the hot 62, and the remainers is 29, which divided by the sum of the quantities in hot, 48 is 29'48 * hot, Then I do the like with the quantities and qualities of moist and dry, and finds it 1 d. 29'48 * dry, which was required.

* Ax. 7.

* Ax. 7.

Exam-

Examples of the Medial Rule Compound in Fractions.

1 Example. *Suppose a peice of board* A. B. C. D. *to be* 3'4 *foot* B. F, 1'2 *foot broad, and* 2'3 *foot* E. D. 2'5 *foot broad; I demand the mean breadth thereof?*

foot l. foot b. products.

3' 4 x 1' 2 = 3' 8
2' 3 x 2' 5 = 4'15

9 | 3'4 | 12 | 45 | 3' 8 | 120
2 | 2'3 | | 32 | 4' 15 |

17' 12 77' 120
17' 12

154' 840
77 ' 120

924)2040(2
1848

192)924(4
768

156)192(1
156

36)156(4
144

12(36(3
36
00

12)924(77'170
84
84
84
00

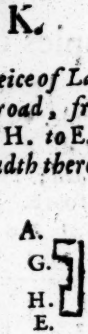
12) 2040(170
12
84
84
000

To do this, I * multiply each party with its compound, as before; Then I * reduce the parts and products each to one denomination, and takes the sum of the products 77'120. for the dividend, and the sum of the parts 17'12. for the divisor, * and so I devide the dividend by the divisor, and the quotient is 924'2040. which * being abreviated is 77'170 which is 2, 8'85 (* being reduced to an integer and proper Fraction) and haveing abreviated the last fraction by the 2. Rule of Reduction.

* *Multiplication of Fractions.*
* 3. *Rule of Reduction.*
* *Division of fractions.*
* 2. *Rule of Reduction.*
* 2. *Rule of Reduction.*

2. Exam-

2. Example. *Suppose there be a peice of Land* A B E *that from* A. *to* G. 1'3 *fall* 3'4 *fall broad, from* G. *to* H. 3'4 *fall* 1'4 *fall broad, and from* H. *to* E. 2'3 *fall* 1'2 *fall broad, I demand the mean breadth thereof?*



1'3 x 3'4 = 3' 12
3'4 x 1'4 = 3' 16
2'3 x 1'2 = 2' 6

12|1'3
27|3'4 } 36| 288 | 3' 12 } 1152
24|2'3 | 216 | 3' 16
| 384 | 2' 6

63 ' 36 | 888 ' 1152
63' 36

16)1152 (72
112 3
32 216
32
00

5328 3456
2664 6912
31968'72576

6)1152 (192
51(0 2
384

12
16
72
12
192
6

12)1152 (96
108 3
72 288
72
00

Abreviat the product 31968'72576 thus,

864) 31968 (37
2592
6048
6048
0000

864) 72576 (84
6912
3456
3456
0000

Answer 37'84 of a fall required.

3. Exam-

3. Example. *Suppose there be a piece of Land, ABF G. that from A to C 3, 3'4 falls is 5, 1'2 falls broad, from C. to D. 2, 1'4 falls, 2 falls broad, from D. to E. 1 fall, 8, 3'4 falls broad, and from E. to F. 1, 1'2 fall 1, 1'2 falls broad, I demand the mean breadth thereof?*

AC 3'75 x 5'50 = 20'625
CD 2'25 x 2'00 = 4'500
DE 1'00 x 8'75 = 8'750
EF 1'50 x 1'50 = 2'250

8'50) 36'125 (4'25
3'40
2'12
1'70
425
425
00

8 X 8
2
4

To do this, decimally, I first * reduce all the fractions to decimal fractions; and work as before in Integers, and finds the mean to be 4'25 falls which is 4, 1'4 falls required.

* 5 Rule of Reduction.

To prove your work in this Rule, if they be of one kind, cast away the nines from the quotient, and likewise from the parties, and multiply their remainers, and cast away the nines from the product; together with the nines of the remainers of your work, and note that remainers. Then cast away the nines from the products, and if that remainers be equal to the remainers which was noted, you have wrought right, otherwise not. If they be of divers kinds, prove each kind severally after the foregoing manner.

But

But if they be of contrary kinds, cast away the nines from each kind and Substract the remainers of that kind which hath the least sum from that which hath the greatest, (by adding nine, if Substraction cannot be made) and if the remainers be equal to that which was noted, you have wrought right, otherwise not.

CHAP. V. *Aligation*

Aligation, is when there is given a mean amongst divers parties, to find the portion of each partie, agreeing to the said mean, a mixture being made thereof.

1 Rule, called Aligation simple.

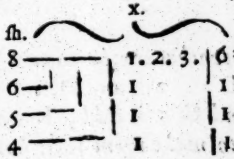
FOR simple Aligation,
From mean take difference of each one,
Contrary place, when joyn'd the be,
Portion against each part ye'l se.

The sense.

TO work Aligation simple, first joyn these which are more then the mean, with these which are less; then take the difference of each one of the parties from the mean, by Substracting the Lesser from the Greater, and set the difference or remainers contrary, that is to say, place the remainers of those which are more then the mean, against those which are Less and joyned therewith, so will the portion of each partie be against it to the right hand.

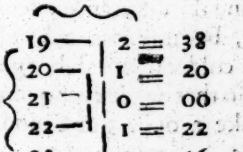
1 Exam-

1. Example. *Suppose I have Wheat, at 8 ſh. the peck, Oats at 6. ſh. Bear at 5. ſh. and Peaſe at 4. ſh. the Peck; how may a mixture of theſe be made to be ſold at 7. ſh. the peck?*



To do this, I ſet down each party in order as they fall in the queſtion, and ſeing there is but one party above the mean given (* it being neceſſary that ſome ought to be above it, and others beneth it) therefore I joyn it to all thoſe which are under the mean, and ſet the differences of each of theſe under the mean to that which is above it, there ſum is 6 for its portion. then I ſet the difference of that which is above the mean, *viz.* 8. to all the reſt, being ſo that there muſt be taken 6 pecks, firlets, or bolls of the wheat for each one of the reſt. * Ax. 15

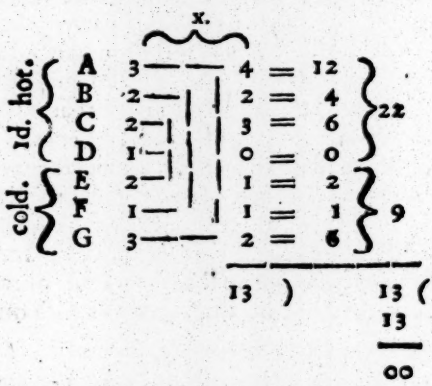
2 Example. *Suppoſe a Mint-maſter be to mix Gold of 19, 20, 21, 22, and 23 carects fine, how much muſt he take of each ſort to make it 21. carects fine?*



To do this, I firſt join that which is above with that which is beneath the mean (as before,) and placeth contrarily as in the Rule is taught, and againſt each party I have its portion (as before) obſerving that againſt 21. Caracts I have

nothing which signifies that *I* may take as much of 21 Carects fine as I please, seing it is the same with the mean, so that what ever quantity you take 2 of 19 Carects fine, you must take 1 of 20. Carects fine, *&c.* whether ounces or pounds, *&c.*

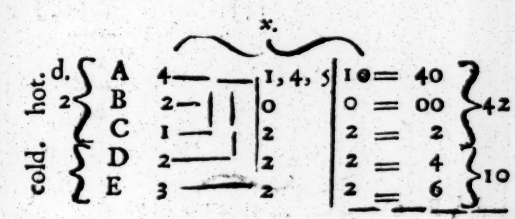
3. Example. *Suppose an Apothecary be to mix these simples,* A. 3 d. *hot,* B. 2 d. C. 2 d. *and* D. 1 d. *hot; with* E. 2 d. *cold,* F. 1 d. *and* G. 3 d. *cold, how much must be taken of each sort, to make them* 1. d. *hot?*



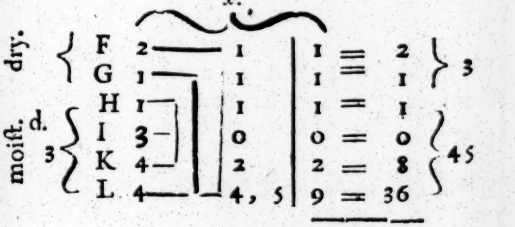
To do this, I joyn that which is above with that which is under, and placeth as before contrairily, observing that in those of the contrary kind to that of the mean, I must add to the mean, to find the difference, seing 2 d. cold is 3 d. from 1 d. hot, because it is 2 d. colder then od. hot, (which is 4 d. colder then 1 d. hot) and so of the rest as they follow. So that what ever quantity you take 4 of A. you must take 2 of B. 3 of C. and as much as you please of D. *&c.*

4. Exam-

4. Example. *Suppoſe an Apothecary mix theſe ſeveral ſimples*, A. 4. d. *hot*, B. 2. d. *and* C. 1. d. *hot*, D. 2. d. *Cold*, *and E.* 3. d. *Cold*; F. 2. d. *dry*, *and* G. 1. d. *dry*; H. 1. d. *moiſt*, I. 3. d., K. 4. d. *and* L. 4. d. *moiſt*; *how ſhall he mix him to make them* 2. d. *hot*, *and* 3. d. *moiſt*?

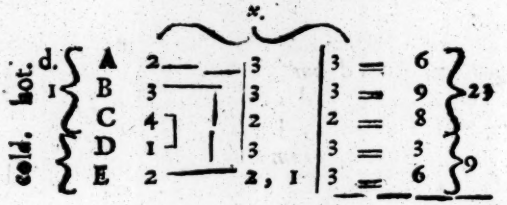


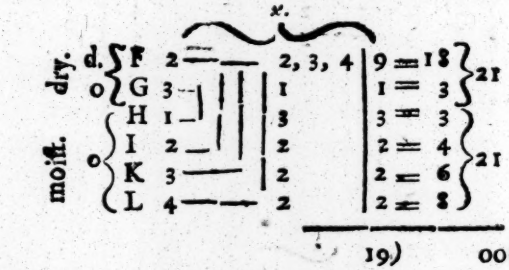
16) 32 (2hot.
32
00



14) 42 (3d. moiſt.

5. Example. *Suppoſe an Apothecary be to mix theſe ſimples*, A. 2. d. *hot*, B. 3. d. *and* C. 4. d. *hot*; D. 1. d. *Cold*, *and* E. 2. d. *cold*; F. 2. d. *and*, G. 3. d. *dry*; H. 1. d. *moiſt*; I. 2. d. *moiſt*, K. 3. d. *and* L. 4. d. *moiſt*; *how much ſhall he take to make them* 1. d. *hot*.





Note that in this last Example I must make the dry and moist temperat, that is, o. d. hot, and o. d. moist.

Examples of Alligation simple, in Fractions.

1 Example. *Suppose a Gold Smith be to mix these metals following*, viz. *Quicksilver whereof* 1'8 *of a solid Inch makes an ounce weight, Lead at* 4'25 *of a solid Inch to the ounce, and Tin at* 1'4 *of a solid Inch to the ounce, how much must he take of each sort, to make the mixture equall to Silver at* 7'39 *of a solid Inch to the ounce, in quantity and weight?*

Q. 390

Q. 3900	1' 8	31200
L. 4992	4' 35	
T. 7800	1' 4	
S. 5600	7' 39	

39) 31200 (800
312 7
000 5600

25
8
200
4
800
39
3) 31200 (3900
700 (0 2
7800

25) 31200 (1248
25 4
62 4992
50
120
100
200
200
00

5600 { 3900 — 2200 / 4992 — 2200 / 7800 — 2308 } 31200 or { Q. 550 / L. 550 / A. 577 } 7800

To do this, * I first reduced all the fractions to one denomination, and so take the difference of each of the numerators from the numerator of the mean 5600 as with the Integers, and there will be 555'7800 of a solid Inch to be taken of Quicksilver & Lead, & 577'7800 of a solid Inch to be taken of Tin, * the fractions being abreviated.

* 3 *Rule of Reduction.*

* 2 *Rule of Reduction.*

2. Example. *Suppose a Founder be to mix these metals following*, viz. *Coper, whereof* 4'89 *ounces make a solid Inch, with Lead and Tin equally mixed, the Lead at* 6'28 *ounces to the solid Inch, and the Tin at* 4'04 *ounces to the solid Inch; I demand how much he must take of Coper, and how much of the mixture of Lead and Tin to make bell metal of* 4'944 *ounces to the solid Inch?*

Lead 6'28
Tin 4'04

2) 10'32 (5'16

4'944 { Coper 4'89] 0'216
Mixture 5'16] 0'054

*Medial Rule simple.

To do this, I first find * the mean weight resulting of the Lead and Tin equally mixed, which is 5'16 ounces to the solid Inch, then according to the Rule I find how much must be taken of the Coper, and how much of the mixture, which I find to be 4 times as much Coper as of the other required, seing 216. is 4 times 54. which is to be taken of the mixture.

3. Example. *Suppose a Founder be to mix these metals following*, viz. *Coper whereof* 4'89 *ounces make a solid Inches with Bell metal, whereof* 4'944 *ounces make a solid Inch; I demand how much he must take of each sort to make metal for great peices of ordinance, at* 4'899 *ounces to the solid Inch?*

Can. metal. 4'899 { Coper 4'890] 0'045
Bell metal 4,944] 0'009

To this, I work according to the Rule, and finds 45 pts. Coper and 9 pts. of Bell metal, which will be 5 pts. of Coper for 1 pt. of Bell metal, to make the metal for Cannons required.

To prove Alligation simple, with the portions found, and simples given, find the mean by the Medial Rule compound (taking the portions found out for the parties, and the simples given to be as these which is compound therewith) which if it be equal to the mean given, you have wrought right, otherwise not.

2. Rule,

2. Rule, called Alligation Compound.

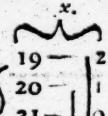
FOR compound Alligation,
Find (as before) each portion,
The Antecedants they will be
For to work by the Rule of three,
Sum given a general conſequent;
Whereby you may find each content.

The Senſe.

TO work Alligation compound, having firſt found the portion of each as before in the ſimple Rule of Alligation is taught, you muſt take them for your Antecedents, that is, for your firſt and third Numbers, when you work by the Golden Rule, or Rule of three, and take the given portion for the general conſequent, or ſecond Number, obſerving to make that which anſwers thereto * the firſt number, and ſo find the portion of each (agreeing to the ſum given) by the Golden Rule.

* *Golden Rule.*

1. Example. *Suppoſe a Mint-maſter mix Gold of* 19, 20, 21, 22, *and* 23. *Carects fine; I demand how much he muſt take of each ſort to make* 34 *ounces* 21. *Carects fine?*

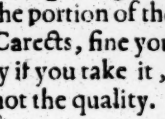


6: 34 :: 2 : 11,2'6
2
6)68 (11, 2'6
0(2
6: 34 :: 1 : 5,4'6
6)34(5, 4'6
(4

proof.
=38
=20
=00
=22
=46
car.
6)126(21
0(0

To do this, I find the portion of each (as before in the ſingle Rule) and finds the ſumme of their portions is 6. then ſeing the whole Maſe is to be 34. ounces; I ſay by the Golden Rule as 6. to 34. ſo is 2. (the portion of the firſt & laſt) to 11,2'6 for the portion of the firſt and laſt agreeing to the 34. given. Then I find likewiſe the portion of the 20. and 22. Carects fine, but for 21. Carects, fine you may take it or leave it as you will, only if you take it, it will Augument the quantity, but not the quality.

2. Example, *Suppoſe I have* 18. *Pecks of Wheat at* 8. ſh. *the Peck, Oats at* 6. ſh. *Bear at* 5. ſh. *and Peaſe at* 4. ſh. *the Peck; how may I make a mixture thereof, to be ſold at* 7. ſh. *the Peck?*



6: 18 :: 1 : 3
1 3
1 3
1 3
9 27

proof.
144
18
15
12
27) 189(7
189
00

To do this, I find the portion of each as before; then I ſay by the Golden Rule, as the portion of the firſt 6. to the quantity thereof given 18. ſo is the portion of the reſt 1. to the quantity of each of them 3. 3. Exam-

3 Example. *Suppose an Apothecary mix these simples* A. 3 d. *hot* 8 *ounces*. B. 2 d, C. 2 d. *and* D. 1 d. *hot, with* E. 2 d. *cold*, F. 1 d, *and* G 3 d *Cold; how shall he mix them to make them* 1 d *hot*?

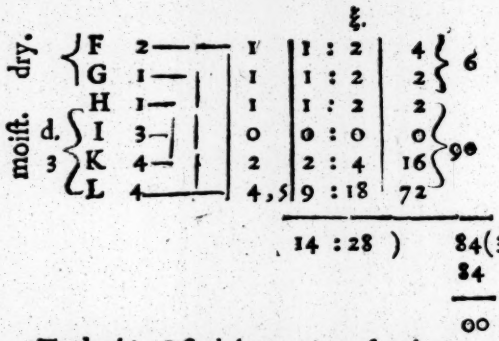
		d.	x	½	℈.	proof.	
hot.	A	3	— —	4 : 8 :: 2 : 4	24		
	B	2	=	2 : 4	8		44
	C	2	|	3 : 6	12		
	D	1	|	0 : 0	0		
cold.	E	2	|	1 : 2	4		
	F	1	— |	1 : 2	2		18
	G	3	— —	2 : 4	12		
				13 : 26	)	26 (1 d. hot.	
						26	
						00	

To do this, I find the portions of each as in the first part of the 3. Example of simple Alligation; then I say by the Golden Rule, as the portion of A. 4. to 8. ounces, so is the portion of each of the rest, to their weight.

1 Example. *Suppose an Apothecary, mix these several simples* A. 4 d. *hot*, B. 2 d. *and* C. 1 d. *hot*. D. 2 d. *cold and* E. 3 d. *cold*, F. 2 d. *dry, and* G 1 d *dry*; H. 1 d. *moist*, I. 3 d. K. *and* L. 4 d. *moist*; *how shall he mix* 3 lb. 12 ℈ *thereof to make them* 2 d. *hot, and* ½ d *moist*?

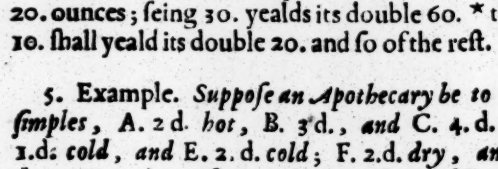
		d.	x	℈.		
hot.	A	4	— —	1, 4, 5	10 : 20	80
d. 2.	B	2	— |	0	0 0	00
	C	1	=	2	2 4	4
Cold.	D	2	— |	2	2 4	8
	E	3	— —	2	2 4	12
					16 : 32)	64 (2. d. hot.
					14 : 28	64
						00
					30 : 60 :: 10 : 20	

dry



To do this, I find the portion of each party as before, and ſo likewiſe I find the ſumme thereof 30; Then I ſay by the Golden Rule as the ſame 30. to 3. lb. 12. ℥. or 60. ounces, ſo is 10. the portion of A, to its quantity
Ax. 21. 20. ounces; ſeing 30. yealds its double 60. * therefore, 10. ſhall yeald its double 20. and ſo of the reſt.

5. Example. *Suppoſe an Apothecary be to mix theſe ſimples*, A. 2 d. *hot*, B. 3 d., *and* C. 4. d. *hot*, D. 1. d. *cold*, *and* E. 2. d. *cold*; F. 2. d. *dry*, *and* G. 3. d. *dry*; *H.* 1. d. *moiſt*, I. 2. d, K. 3. d, *and* L. 4. d. *moiſt*; *how ſhall he mix* 22. *ounces thereof to make them* 1. d. *hot.*



First, for A. I ſay which ſerves likewiſe B, D, E, and H.

33 : 22 : : 3 : 2

3

33) 66(2

66

00

Second

Secondly, for C. I say which serves likewise for I, K. and L.

33 : 22 : : 2 : 1, 1'3

2

33)44(1

33

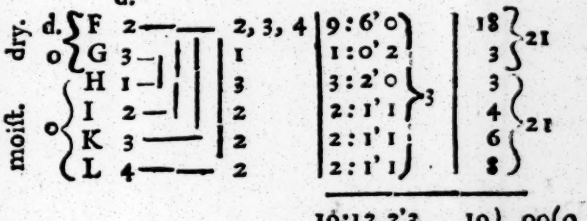
11 (1'3

11)

33

33

00



19:12,2'3 19) 00(0

Thirdly, for F. I say

33 : 22 : : 9 : 6

9

33) 198 (6

198

00

Fourthly, for G. I say

33 : 22 : : 1 : 0,2'3

11) 33 (3 11) 22 (2

33 22

00 00

To

To do this, I find the portion of each as before, and ſayeth by the Golden Rule, as the ſumme of the portions 33. to the ſumme given 22. ounces, ſo is 3 (the portion of A, B, D, E and H) to 2. ounces (to be taken of each of them) Then for C, I, K, and L. I ſay, as 33. to 22. ſo is 2. (their portion) to 1, 1'3 ounce (to be taken of each of them). Thirdly for F. I ſay, as 33 to 22 ſo is 9 (the portion of F) to 6 ounces to be taken thereof; Fourthly for G. I ſay, as 33 to 22 ſo is 1 (the portion of G.) to 2'3 ounces to be taken thereof.

Examples of Alligation Compound, in Fractions.

1 Example. *Suppoſe in that Crown mentioned by* Vitruvius (*wherein* Archimedes *found out the proportion of Gold and Silver whereof it was made*) *there had been found* 1'8 *of a ſolid Inch to the ounce*; *I demand how much Gold was in it at* 1'10 *of a ſolid Inch to the ounce, and how much* Silver *at* 7'39 *of a ſolid Inch to the ounce, the whole Maſs being* 6 lb. *weight*?

Gold	312	1' 10	}	
Mixture	560	7' 39	}	3120
Silver	390	1 8	}	

10 x 39 = 390
8

10) 3120

39) 3120 (80
312 7

000 560

390

```
                    lb.
390 { 312 ] 170  4,  7 } 62      8)3120(390
    { 560 ] .78  1, 55 }            70(0
          ---------------
          248 : 6 :: 78 : 1, 55/62        lb.      lb.
                     6                 248 : 6 :: 170 : 4 7/62
                                                      6
                 ---------                      ---------
          248) 468 (1                     248(1020(4
               248                            992
               ---                            ---
               220                             28
          4)---(55/62                     4)---(7/62
               248                            248
```

To do this* I reduce them all to one denomination, and so worketh with the Numerators as before in Integers, and findeth 4 lb. 7'62 of Gold, and 1 lb. 55'62 of Silver (* the fractions being abreviated) which will be 4 lb. 1 ou. 12 dr. 31 gr. 16'31 of Gold and 1 lb. 14 ou. 3 dr. 3 gr. 15'31 of Silver (* the fractions being reduced to ounces &c.) and the last fractions abreviated by the 2 Rule of Reduction.

** 3 Rule of Reduction.*

** 2 Rule of Reduction.*

** 5 Rule of Reduction.*

2 Example. *Suppose I have 1'2 ounces of Quick-Silver at 8'1 ounces to the solid Inch, Lead at 6'28 ounces to the solid Inch, and Tin at 4'04 ounces to the solid Inch; I demand how much must be taken of each sort to make the said mixture equaly in Quantity wight to Silver at 5'61 ounces to the solid Inch?*

```
        { 8'10 —   1'57          | 1'57
5'61    { 6'28 —   1'57          | 1'57
        { 4'04 —   2'49 + 0'67   | 3'16

1'57 :   5   : :   3'16
1'57 :   5   : :    '5
                 ---------
3'16 : 1'0, 10' 1'57) 1'580 (1'0, 10
                      157        157
                      ---
                       10
```

To

To do this decimal, seeing they are all Integers and decimal fractions, I work as before in Integers, (only *Reducing the 1'2 ounce which was given of Quick-silver to a decimal fraction) and finds I must take likewise 1'2 ounce of Lead, and 1, 1'157 ounce of Tin, which was required.

*5 Rule of Reduction.

Note, that in *Alligation*, either simple or compound, if both the Greater and Lesser Extrems be plural, that they may be so linked diversly, and so often, that the Question proponed may admit of many Answers, and yet all true; but if either of the Extrems be single, it being linked with all the rest, can admit of no more answers then one, according to the Rules of *Alligation*, although otherwise it may, if the number of simples given be more then two; by which it may appear that the proportion of Metals for Bells and Cannons set down in simple *Aligation*, and of the Crown in the 1. Example of compound *Alligation*, cannot hold true if the simples given be more then two.

To prove your work in *Alligation* compound, with the portions found last out and simples given, find out the mean by the Medial Rule compound (taking the portions found out for the parties, and the simples given, to be as these which is compound therewith) which if it be equal to the mean given, you have wrought right, otherwise not.

Or you may prove the portions first found out as in simple *Alligation*, and the portions last found out, as in the Rule of *Fellowship*, if the summe be given especially, if there fall any Fractions. But if one of the portions be given, say by the Golden Rule, as that which answereth to the portion given, to the said portion given, so is the summe of the first, to the sum the second portions.

CHAP.

CHAP. VI. *Supposition.*

SUpposition, is when we suppose any number to be the true number, and worketh therewith as the true one, so that by the error or errors found, we find the true number required.

1. Rule, called the single Rule of Supposition.

FOr single Supposition
Suppose and work as truth were known,
And if you err, which may well be;
Then work this, by the Rule of three,
As summe thus found, to what was known;
So that supposed, to the right one.

The Sense.

TO work single Supposition, first suppose any number at pleasure, and work therewith as the question importeth, and if you err from the thing given, (as oft times it happeneth), say by the Golden Rule, as the summe found, to the summe given, so is that number which you supposed, to the true number required.

To

To know whether a queſtion propounded be of the ſimple or Compound Rule of Suppoſition.

When there is a partiton of numbers in parts proportionall it is of the ſimple Rule of Suppoſition.

But if there be no partiton in the numbers to make a proportion, but that in following the tenor of the queſtion according as it requireth, you find it increaſe or decreaſe in an Arithmetical progreſſion; that is to ſay, by addition or ſubſtraction, it is of the Compound Rule.

1 Example. *Suppoſe* 3 *men* A. B. *and* C, *have* 356 lb. *to be devided ſo amongſt them, that* B. *is to have* 3 *times ſo much as* A. *and* C. 4 *times ſo much as* B. *how much muſt each have?*

Suppoſe A. lb. B. lb.

50 x 3 = 150 x 4 = 600

B 150
C 600

lb lb. lb.
800. 356 : : 50 : 22, 1'4
50

800)178|00(22, 1'4
1(2
2)—(1'4
8

Proof A. lb. B. lb.
22, 1'4 x 3 = 66, 3'4 x 4 = 267
66, 3'4
267'

356 which ſheweth the work to be right done.

To do this I ſuppoſe 50 lb. for A. and multiplieth by 3. for B. 150lb. which I multiply by 4. for C. 600 lb. all which added together, the ſumme is 800. lb. whereof

as it ought to be 356 lb. therefore I say, as 800 lb. to 356 lb. so is 50 lb. to 22, 1'4 for A. which multiplied by 3. is 66, 3'4 for B. which multiplied by 4. is 267. for C. all which added together, the summe is 356. which showes the work to be right.

2. Example. *Suppose one should say to another, if I had as much and half as much and* 6 lb. *over, I should have* 396 lb. *I demand how much he had?*

Suppose	100 lb.	
As much	100	396
half as much	50	6

250 : 390 :: 100 : 156

Proof

	156
	78
	6
	396

25|0) 3900|0 (156
250
140
125
150
150
00

To do this, I suppose first 100. then as much is 100. and half as much is 50. all which added together is 250 lb. but it ought to be 390 lb. (substracting the 6 lb. over, otherwise it would be in the Compound Rule) therefore, I say as 250 lb. to 390. so is 100 to 156 lb. to which I add as much 156 lb. and half as much 78 lb. and 6 lb. over, and the summe is 396 lb. which showes, your work is right.

Examples of ſingle Suppoſition in Fractions.

1. Example, *what numbers are they whoſe* 5'6 *of the one* A. *is* 4'7 *of the other* B ?

Suppoſe for A - - 18
Then 5'6 thereof is - 15
Then Suppoſe for B - 21
Then 4'7 thereof is - 12 : 15 : : 21 : 26, 1'4

15
105
21

Then 26, 1'4 x 4'7 is 105'7 = 15

12)315(26, 1'4
24
75
72
3
3)—(1'4
12

To do this, I firſt ſuppoſe any number compound of the Denominator of the firſt A. which is 18. and then takes the 5'6 thereof which is 15. then ſecondly I ſuppoſe for B. 21 But the 4'7 thereof is 12, whereas it ought to be 15. therefore I ſay, as 12 : 15 : : 21 : 26, 1'4. whoſe 4'7 is 15 required. Note that this Queſtion is capable of many anſwers, except A be given, for A might be 36. and then B. would be 52, 1'2, or A might be 72. and then B. would be 105. *&c.*

2 Exam-

2. Example. *Suppose a Cistern with 3 Cocks A. B. and C. wherein if A. be set open, all the Water will run out in 3. houres, and B. being set open, it will run out in 5. houres; but if C. be set open, it will run out in 7 houres; I demand how long it shall be a running out, all the Cocks being set open?*

I suppose in 2. houres.

The 3. pt. thereof will be for A. which is	70	2'3	105
The 5. pt. will be for B. which is . .	42	2'5	
And the 7. pt. will be for C. which is .	30	2'7	
Their summe is . .	142		

```
   3          5) 105 (21        7)105(15
   5             0(0  2           3(0  2
  ---            ---              ---
  15              42               30
   7
  ---
3)105(35
  1(0  2
  ---
   70
```

Then I say, 142 : 105 :: 2 : 1, 34'71 whereof the { 3pt. is 35, 5pt. is 21, 7pt. is 15 } 71 . 2 / 42 — 2 / 30

```
  105
    2
  ---
142)210(1
    142
    ---
     68
2)----(34/71
  142
```

The proof 71 required

To do this, I first * reduce all the fractions to one Denomination, and addeth them together, and the summe is 142. But it ought to be equal to the Denominator 105, therefore I say 142 : 105 :: 2 : 1, 34'71 required. *3. Rule of Reduction.*

3. Example. *Suppose there are two numbers* A. *and* B. *the lesser of which* A. *hath such proportion to the greater* B. *as* 2, 4'5 *to* 6. *and the summe of the said numbers hath such proportion to the summe of their squares, as* 5, 1'2 *to* 68, 1'2. *I demand each of the numbers?*

I suppose A. to be 14. then for B. I say 2'8 : 6 : : 14 : 30
Then for B I find 30

Their summe is 44

11
2'8)84'0(30
84
00'0

Then for the summe of the squares, I say

5'5 : 68'5 : 44 : 548

44
274'0
2740
5'5)3014'0(548
275
264
220
44'0
44 0
00

14 30
14 30
56 900
14
196 square of A.
900 square of B.
1096 their summe is

Therefore I say 1096 : 548 : : 14 : 7

14
2192
548
1096)7672(7
7672
000

Now

Now having found A. to be 7
I find B. thus . . 2'8 : 6 : : 7 : 15
So is B. found to be 15 — 7
Their summe is . 22 — 2'8) 42'0 (15
28
14'0
14'0
00

Then for the summe of their squares, I say

5' 5 : 68'5 : : 22 : 274
22
137'0
1370
5'5) 1507'0 (274
110
407
385
22'0
22'0
0'0

35 — 7
15 — 7
75 — 49
15

square of B. 225
square of A. 49
Their sum is proof 274

To do this decimaly, * I reduce all the fractions to decimal fractions, and so worketh according to the Rule, as if they were Integers. *5. Rule of Reduction.

To prove your work in single supposition, work with the numbers found out as the question importeth, and if it produce the number, or numbers given, you have wrought right, otherwise not.

2 Rule, Called the Compound Rule of Suppoſition.

FOR Compound Suppoſition,
Suppoſe and work ſet Errors down,
Suppoſe again work as before,
Note Errors down with leſs or more,
Errors with Suppoſitions ye
Contrary wiſe the multiply,
If like Subſtract if unlike add
Errors, likewiſe the products made,
What comes of products then divide
By that of Errors, for your guide.

The Senſe.

TO work the Compound Rule of ſuppoſition, firſt ſuppoſe and work as the queſtion Importeth, and if you erre ſett down the error, Noting it with + more or — leſs, then ſuppoſe again and work as before, & note the error down likewiſe with + more or — leſs. Then you muſt multiply contrary wiſe, the firſt ſuppoſition by the ſecond error, and the ſecond ſuppoſition by the firſt error, then if the errors be noted with like ſigns that is both + more or both — leſs, ſubſtract the leſſer product from the greater for the dividend, and the leſſer error from the greater for the diviſor; But if the ſigns be unlike; that is, the on + and the other — add the products for dividend, and the errors for diviſor, divide; and the quotient will be the true number ſought.

1. Exam

1 Example. *Suppose a Maßon agree to work 20 dayes, at 12 ſh. the day, and that he is 10 rebat 1 lb. 10 ſh. for each day that he is idle, and having received in the end 7 lb. 16 ſh; I demand how many dayes he wrought and how many dayes he was idle?*

10 x 12	=	120	12 x 12	=	144
10 x 30	=	300	8 x 30	=	240
		— 180			— 96
		156			156
1. Error		— 336	2. Error		— 252
		12			10
		672			2520
		336			

336 | 4032
252 | 2520

d. ſh.

84) 1512 (18 x 12 = 216
84 2 x 30 = 60

672 Proof 156
672
00

To do this, I firſt ſuppoſe and I work as the Queſtion Importeth, and the error is 336 too litle, then I ſuppoſe again and work as before, and the error is 252 too litle for the ſecond error, which I multiply by the firſt ſuppoſition, and the product is 2520, then I multiply the firſt error 336 by 12. the ſecond ſuppoſition and the product is 4032, Then ſeeing the errors are both noted with — leſs, I ſubſtract the leſſer product from the greater and their reſts 1512 for the dividend, and likewiſe I ſubſtract the Leſſer error from the greater, and their reſt

84 for the diviſor, ſo by dividing the dividend by the diviſor I find the quotient to be 18. for his working dayes at 12 ſh. is 216 ſh. and 2 dayes he was idle for which I muſt rebate 2 times 30. that is 60 ſh. their reſts 156 ſh. which is 7 lb. 16 ſh. proves the work to be right done.

2 Example. *Two men* A. *and* B. *had ſeveral ſummes of mony*, A. *ſaid to* B. *if you give me* 4 lb. *I ſhall have double of what you have, and* B. *ſaid to* A. *if you give me* 4 lb. *I ſhall have equal to what you have; I demand what each man had?*

1. I Sup. A. 16 + 4 = 20. then $\frac{20}{2}$ = 10, + 4 = B. 14

But B. 14 + 4 = 18
and A. 16 − 4 = 12

1. Error — 6

2. I Sup. A. 18 + 4 = 22. then $\frac{22}{2}$ = 11, + 4 = B. 15

But B. 15 + 4 = 19
and A. 18 − 4 = 14

2. Error — 5

1. Supp. 16 − 6
2. Supp. 18 − 5

108 − 1
80

A. 28

Proof.

A. 28 + 4 = 32
B. 20 − 4 = 16 } double

Again

B. 20 + 4 = 24
A. 28 − 4 = 24 } equal

To do this, I firſt ſuppoſe A. had 16 lb. which added the 4 lb. that B. was to give him makes 20 lb. then

then B. ought to have but 10 lb resting, and consequently had 14 lb. before, but if A lend B. 4 lb. from his 16 lb. B. will have 18 lb. and A. will have but 12 lb. which is 6 lb. too little; therefore I mark the first Error 6 lb. by —, then I suppose again 18 lb. for A. and work as before, and finds the 2. Error 5 lb. too little, which I mark likewise down by —, Then I multiply the 1. Error 6. by the 2. Supposition 18 lb. the product is 108 lb. & the 2. Error 5. by the 1 Supposiron 16 lb. and the product is 80 lb. the difference of the product is 28 lb. & of the Errors is 1. *which divideth not, therefore is 28 lb. that which A. had, to which I add 4 lb. that B. give him makes 32 lb. the half of which is 16 lb. for that which B. hath resting, and consequently ought to have 20 lb. before, Then if A. give B. 4 lb. from his 28 lb. A will have 24 lb. so likewise will B. which showes the work to be right, which was required. * A. 12.

Examples of Compound Supposition in Fractions.

1. Example. *Suppose a Cistern with two Cocks, A. and B. set open at once, all the water will run out in 3. houres, but the Cock A. alone being set open, it will run out in 9. houres; I demand how long it shall be a running out the Cock B. alone being set open?*

1. I Suppose 4. houres for B.

Which will make with the compound time 27 | 3'4 } 36
And A. 9 h. will make with the said time 12 | 3'9 }

Their summe is . . 39
But it should be equal to the Denominator 36

Therefore the first Error is . + 3

2. I Suppose 6. houres for B.

Which will make with the compound time 27 | 3'4 } 36
And A. 9. h. will make with the said time 18 | 3'9 }

Their summe is . . 45
But it should be equal to the Denominator 36

Therefore the second Error is . — 9

1 Sup. 4 + 3 : 1. error
2 Sup. 6 — 9 : 2. error

36 12 13, 1'2 | 3' 9 } 40, 1'2
18 27 | 3' 4, 1'2 }

12)54(4, 1'2 proof 40, 1'2 : 40, 1'2
48

6

6)——(1'2
12

To do this, I first suppose 4. houres for B. which makes 3'4 (with the time that the water would be a running out, if both Cocks were set open at once) and A. will make 3'9 (with the said time) then * I reduce both these Fractions to one Denomination, and addeth them together, and they make 39. which is more then the Denominator 36. by 3. (which is the 1 Error) then I suppose again 6. houres, and worketh therewith as before, and findeth the 2. Error 9. too little; then I work according to the Rule with the Suppositions and Errors, and finds the time for B. to be 4, 1'2 houres required.

* 3 *Rule of Reduction.*

2. Example, *Suppose* 4. *Partners* A. B. C. *and* D. *having money*, A. *should say to* B. *if you give me the* 1'2 *of your money I shall have* 156 lb. *and* B. *should say to* C. *if you give me the* 2'5 *of your money*, I *shall have* 185 lb. *and* C. *should say to* D. *if you give me* 1'5 *of your money*, I *should have* 342 lb. 10. sh. *But* D. *said if* I *should give you* 57. lb. 15. sh. I *shall have as much remaining as you have all*; I *demand how much money each man had*?

1. E

1. I ſuppoſe A. to have . . 100

Then 156 — 100 = 56 whoſe '5 is B. 112
And 185 — 112 = 73 whoſe '4 is C. 182'5

And 342'5 — 182'5 = 160 whoſe '2 is D. 800
From which ſubſtract . . . . 57'75

Reſts yet for D. . . . 742'25

Then the ſumme of the other three is 394'5
To which add . . . . 57'75

The Tottal is . . . . 452'25
But it ſhould be equal to . . 742'25

The 1. Error is . . . . + 290

2. I Suppoſe A. to have . . 120

Then 156 — 120 = 36 whoſe '5 is B. 72
And 185 — 72 = 113 whoſe '4 is C. 282'5

And 342'5 = 282'5 = 60 whoſe '2 is D. 300
From which ſubſtract . . . 57'75

Reſts yet for D. . . . 242'25

Then the ſumme of the other three is 474'5
To which add . . . . 57'75

The Tottal is . . . . 532'25
But it ſhould be equal to . . 242'25

The 2. Error is . . . — 290

The 1. Suppoſition for A. is . 100 + 290
The 2. Suppoſition for A. is . 120 — 290

The 1. Product . . . 29000 580
The 2. Product . . . 34800

Their Summe is Dividend . . 63800

58 |0) 638 0[0 (110 for A.
58
58
58
00

Having now found for A. . . 110

Then 156 — 110 = 46 whose '5 is B. 92
And 185 — 92 = 93 whose '4 is G. 232'5

And 342'5 = 232'5 = 110 whose '2 is D. 550
From which substract . . . 57'75

Rests yet for D. . . . 492'25

Then the summe of the other three is 434'5
To which add . . . . 57'75

The summe proves the work . . 492'25

5. *Rule of Reduction.* To do this decimally, I first * reduce all the fractions to decimals, then I suppose A. first to be 100 lb. and substracteth it from 156. which he should have with the half, or '5 of B's money their rests 56 lb. for the half, or '5 of B.'s money and consequently B. should have 112 lb. and so I proceed to the end, where I find the 1. Error to be + 290 lb. Again, I suppose A. to be 120 lb. & worketh therewith as before, & finds the second Error to be — 290 lb. with which two suppositions and errors, I find out A. to have 110 lb. (according to the Rule) and so finds out the rest as before, *viz.* B. to have 92 lb. C. 232 lb. 10 sh. (* the '5 being reduced to shill.) which was required.

* 5. *Rule of Reduction.*

Note, that there is many Questions that may appear to be in this Rule, which will not be found out thereby, as when you must need more then two suppositions, that is when you have wrought with the number found, it doth not prove your work, then it is most fit to find the truth by *Simon Steven's* generally Rule.

Prove your work as in single supposition.

CHAP.

CHAP. VII. *Ceres* and *Virginum* Simple.

Ceres and *Virginum* ſimple, is when there is a ſumme given to be divided into two or more parts that each one of them multiplied by a different multiplier, the ſum of their products ſhall be equal to a given ſum.. e of products.

The Rule.

Ceres to work ſum given ye
Muſt by leaſt number multiplie,
rom products ſum that product take
hat reſt the dividend will make,
y difference then and ſum divide
leaſt and greateſt, ſtill that 'bide.
uotients will bounds of greateſt ſhow
y which ye may the leaſt ſtill know.

The Senſe.

TO work the Rule of *Ceres* and *Virginum* Simple you muſt multiply the ſum given to be divided by the leaſt multiplier, and ſubſtract the product thereof from the ſum of the products given, and the remainers will be the dividend, which divide by the diffe-

difference of the Leaſt and Greateſt multipliers, and the quotient will be a number which that which belongeth to the greateſt cannot exceed, but if you divide by their ſumm, the quotient will ſhew you that, which the part belonging to the greateſt cannot be much Leſs.

1 Example. *Suppoſe I were to buy 12 pecks of Oats, and Bear for 4 lb. the oats at 6 ſh. the peck, and the bear at 8 ſh. the peck, how many pecks may I take of each ſort?*

8	12	4 lb.
6	6	20
2	72	80
		72 pecks

2) 8 (4 x 8 = 32

The remainers to 12. is 8 x 6 = 48

Their ſum is proof 80

To do this, I firſt multiplie the given ſum of pecks by the leaſt price 6. and the product is 72. which take from the given ſum of the products 80 ſh. (being the 4 lb. * reduced into ſhillings) the remainer is 8 pecks for the dividend, which I devide by the difference of the prices 2. and the quotient is 4 pecks to be taken of the bear, and there will remain 8 pecks to be taken of the oats. But their ſum would be 14. which is greater than the dividend 8. therefore I can take no leſs of bear than 4 pecks nor yet more.

* 5. *Rule of Reduction.*

2 Example. *Suppoſe 20 perſons ſpend 3 lb. 10 ſh. at a feaſt, ſo that men payes 8 ſh. Women 5 ſh. and Childr 2 ſh.; how many may be of each ſort?*

8	20	70	6) 30 (5
2	2	40	(0
6	40	30	

4 x 8 = 32. then 70 — 32 = 38

5	16	38	3) 6 (2
2	2	32	(0
3	32	6	

4 x 8 = 32		3 x 8 = 24	
2 x 5 = 10	or	4 x 5 = 20	
14 x 2 = 28		13 x 2 = 26	
20 proof 70		20 proof 70	

To do this, I first find the outmoſt bounds of the greateſt price 8. ſh. *viz.* 5. Therefore I take 4. thereof (ſeeing 5. the outmoſt bounds thereof is too much, becauſe the reſt would remain to the nixt, ſo there would be none for the leaſt) and there will remain 16 (of the ſumme given 20) and 38 (of the ſumme of the products) Then I find the greateſt bounds of the nixt greateſt 5. as before, *viz.* 2. and there will remain 14. for the leaſt, or I may take 3. for the greateſt, &c. as alſo I may take 2. or 1. ſeeing the nixt greateſt is ſo near thereto.

Examples of *Ceres* and *Virginum* ſimple in Fractions.

1. Example. *Suppoſe I am to buy of ſundry commodities* A. B. C. *and* D. *to the value of* 14 lb. *and that* A. *coſt* 2'3 lb. *the pound weight* B. 1'2 lb. C. 1'3 lb. *and* D. 2'7 lb. *the pound weight and being to buy* 28 lb. *weight of all how much may I take of each ſort?*

A. 14 | 2' 3 } 21
D. 6 | 2' 7 }

28'1
2'7

14
8

diff. 8 } 21
S. 20 }

product 56'7
or 8

divid. 6' 1
8'21

6'1
20 21

126'8

126'20

8) 126 (15,3'4 G. bound
4 (6
2) — (3'4
8

2 | 0) 12 | 6 (6'3
0 (6
2) — (3'10
20

A. 15 x 2'3 = 10
Then 14 — 10 = 4
and 28 — 15 = 13

B. 7 | 1' 2 } 14
D. 4 | 2' 7 }

13' 1
2' 7

4
3, 5' 7

diff. 3 } 14
S. 11 }

prod. 26'7
or 3, 5'7

divi. 2' 7
3' 14

2'7
11' 14

28' 21

28' 77

21) 28 (1, 1'3 G. bound
21

28
7) — (4'11
77

7
7) — (1'3
21

B. 1. x 1'2 = 1'2
Then 4 — 1'2 = 3, 1'2
And 13 — 1 = 12

C. 7 | 1' 3 } 21
D. 6 | 2' 7 }

12' 1
2' 7

3,7 | 1' 2 } 14
3,6 | 3' 7 }

diff. 1 } 21
S. 13 }

product 24'7
or 3, 3'7

1 ' 14
1 ' 21

21 ' 14

14) 21 (1, 1'2
14
7
7) 1'2
14

C. 1, 1'2 x 1'3 = 1'2
Then 3, 1'2 — 1'2 = 3
And 12 — 1, 1'2 = 10, 1'2
D. 10, 1'2 x 2'7 = 3 which proves the work.

To do this, * I first reduce the greateſt and leaſt to one Denomination, and ſo finds the difference to be 8' 21. and the ſumme 20'21. Then I multiply the given ſumme 28 or 28'1 (being placed Fraction wiſe) by the leaſt 2'7 and the product is 56'7 or 8. (* being reduced to an Integer) which taken from the given ſumme of products 14. there reſts 6. or 6'1 (* being placed Fraction wiſe) which divided by the foreſaid difference 8'21 and the quotient is 126'8. or 15, 6'8 (* being reduced to an Integer and proper Fraction) for the greateſt bounds of A. and by dividing the foreſaid dividend by the foreſaid ſumme 20'21 the quotient will be 6'3 (being reduced as before) then I take 15. for A. which multiplyed by 2'3. makes 10. Then 10. taken from the given ſumme of the products 14. there reſts 4. for the ſumme of the products remaining, and then I take 15. (which muſt be taken of A) from 28 (the given ſumme) reſts 13. for the remaining ſumme, by which two remaining ſummes, with that which belongeth to the nixt greateſt B. 1'2 and leaſt D. 2'7. I find the greateſt and leaſt bounds of B. as before 1, 1'3 and 1'11. then I take 1. for B. and ſo proceedeth as before, for the ſumme of the products 3, 1'2 and ſumme of the parties 12. remaining for C. and D. then I find for C. 1, 1'2 and their reſts 10, 1'2. for D. the proof is eaſy.

* 3. *Rule of Redu. ction.*
* *Deff.* 19
* 4. *Rule of Redu-ction.*
* *Deff.* 19
* 4. *Rule of Redu-ction.*

2. Rule. *Ceres* and *Virginum* compound.

IN Compound Ceres truth to find,
Ad multipliers of each kind.
As with themſelves you wrought before,
Work with their ſummes, but change no more.

The Senſe.

TO work *Ceres* and *Virginum* Compound add al the Multipliers belonging to each party together and work with their ſummes as before you did wit themſelves in ſimple *Ceres* and *Virginum.*

1. Example. *Suppoſe* 14. *Perſons conſiſting of Me and Women ſpend* 8 lb. 10 ſh. *at a Feaſt, where eac Man payes* 10 ſh. *for meat, and* 6 ſh. *for drink; an each Woman* 8 ſh. *for meat, and* 2 ſh. *for drink; ho many Men, and how many Women are there in all?*

10+6 = 16
8+2 = 10

14 x 10 = 140
170

6) 30 (5 x 16 = 8
(0 9 x 10 = 9

The Proof 17

To do this I firſt add the multipliers belonging to t Men, *viz.* 10 ſh. and 6. ſh. the ſumme is 16 ſh. the firſt multiplier, then I add the multiplies belon ing to the Women, *viz.* 8 ſh. and 2 ſh. the ſumme is ſh. for the other multiplier, with which two I work before in ſimple *Ceres* nnd *Virginum.*

2. Exa

2 Example. *Suppose* 20. *Persons consisting of Men, Women, and Boys, spend in whole* 8. lb. *at a Feast, where each man payes* 6. *shillings for meat, and* 4. *shillings for drink, and every Women* 4. *shillings for meat, and* 2. *shillings for drink, and every Boy* 3. sh. *for meat, and* 1. sh. *for drink; how many may be of each sort?*

6 + 4 = 10	20	8	160
4 + 2 = 6	4	20	80
3 + 1 = 4	80	160	6)80(13, 1'3
			2(2
			2)—(1'3
			6

13 x 10 = 130		12 x 10 = 120		11 x 10 = 110	
1 x 6 = 6	or	4 x 6 = 24	or	7 x 6 = 42	
6 x 4 = 24		4 x 4 = 16		2 x 4 = 8	
Proof 160		Proof 160		Proof 160	

Examples of *Ceres* and *Virginum* Compound in Fractions.

1. Example. *Suppose a Merchant buy* 30 lb. *of several sorts of Goods for* 24 lb. *so that each pound weight of* A. *cost* 3'4 lb. *and* 1'8 lb. *of Expenses (in bringing them home with the Customs and other dues) and each pound of* B. *cost* 2'3 lb. *and* 1'6 lb. *of expenses, and each pound of* C. *cost* 1'2 lb. *with* 1'4 lb. *of Expenses; how much might he have taken of each sort?*

3'4 + 1'8 = 7'8
2'3 + 1'6 = 5'6
1'2 + 1'4 = 3'4

30'1
3'4 24

90'4 that is 22, 1'2

1, 1'2 or 3'2
1'8
24'2

So their is found out 24'2 or 12. for A's greateſt bounds.

10 x 7'8 = 70'8 or 8, 3'4 then 24 — 8, 3'4 = 15, 1'4
& 30 — 10 = 20, x 3'4 = 15 then 15, 1'4 — 15 = 1'4

20|5'6 } 24
18|3'4 }

2'24 or 1'12

1'4
1'12

12'4 or 3 x 5'6 = 15'6 or 2, 1'2

10 x 7'8 = 70'8 or 8, 3'4
17 x 3'4 = 51'4 or 12, 3'4

The Proof 24

* *Addition in Fractions.*

To do this * I add firſt the multipliers of each kind, and ſo worketh with their ſummes as before with themſelves in ſimple *Ceres* and *Virginum*, as firſt 3'4 + 1'8 = 7'8 (becauſe 3'4 = 6'8 by doubling the 3'4 and ſo of the reſt, as in the work.

2. Example. *Suppoſe a Merchant buy* 45, 1'2 *ells of ſeveral ſorts of Cloath for* 208 lb. 4 ſh. *ſo that each ell of* A. *coſt* 6 lb. 8 ſh. *and* 10 ſh. *of expences, and each ell of* B. 4 lb. 12 ſh. *with* 8 ſh. *of expences, and each ell of* C. 3 lb. 14 ſh. *with* 4 ſh. *of expenſes, and each ell of* D. *coſt* 2 lb. 6. ſh. *with* 2 ſh. *of expenſes; How much might he have taken of each ſort?*

A. 6'4 + '5 = 6'9
B. 4'6 + '4 = 5'0
C. 3'7 + '2 = 3'9
D. 2'3 + '1 = 2'4

diff. 4'5
Summe 9'3

45'5
2'4

1820
910

109'2

208'2
109'2

4'5)99'0(22
90

90
90

00

20 x 6'9 = 138 then 208'2 − 138 = 70'2
Then for the ſumme that reſts 45'5 − 20 = 25'5

B. 5'0	25'5	70'2
D. 2'4	2'4	61'2
diff. 2'6	1020	2'6) 9'0 (3,6'13
ſumme 7'4	510	7'8
	61'20	1'2
		3)—6'13
		2'6

3 x 5'0 = 15'0, then 70'2 − 15'0 = 55'2
Then for the ſumme remaining 25'5 − 3'0 = 22'5

C. 3'9	22'5	55'2
D. 2'4	2'4	54'0
diff. 1'5	900	1'2
Summe 6'3	450	3)—(4'5 or'8
	5400	1'5

20 x 6'9 =	138		18'0 x 6'9 = 124'20
3 x 5'0 =	15	or	6'0 x 5'0 = 30'00
'8x 3'9 =	3'12		1'6 x 3'9 = 6'24
21'7x 2'4 =	52'08		19'9 x 2'4 = 47'76
Proof	208'2		Proof 208'2

To do this decimally, I firſt * reduce all the fractions to decimals, and ſo worketh therewith as before with Integers. The proof is eaſy. * 5. Rule of Reduction.

Note, that the queſtions in this Rule is capable of many Anſwers, if the kinds given be more then two. So that if Fractions were admitted their might be Innumerable Anſwers within the bounds of the greateſt, as may appear in the foregoing Examples. The proof of this Rule is eaſy.

CHAP. VIII.

The Rules of Practice.

THese Rules are only a contracting or shortning of the operations in the foregoing Rules, and depends much upon the aliquot parts, or even Divisors of Integers, which may be found out by this Rule.

If the number given be an even number, you must first divide it by 2. then if the quotient be even divide it by 2. and so continue to divide each quotient by 2. untill it happen to be an odd number; then divide by 3. so long as it will divide thereby, after which you must try with 5, 7, 11. &c. after the same manner, that is by every prime number, until the quotient be less then the Divisor, then by these prime Divisors you may find out all the rest thus,

Multiply the first Divisor by the second, then multiply the third by all the Divisors and Products before, and so likewise with the fourth and fifth, &c. if there be so many, only you need not multiply any whose equal hath been multiplied already.

1. Example. *Suppose it be required to find all the aliquot parts, and just Divisors in* 12, *I place and work thus.*

2

2) 12 (6
2) 6 (3
3) 3 (1

2, 2, 3.
4, 6.
12.

To do this, I first divide 12. by 2. the quotient is 6. which I divide by 2. and the quotient is 3. which I divide by 3, and the quotient is 1. Then I multiply the first Divisor 2. by the second 2. and the product is 4. then I multiply the third 3. by the first 2 makes 6, and then by the product of the first and second 4. (seeing I need not multiply by the second 2. because it is equal to the first 2) the product is 12. so I find 4 aliquot parts 2, 3, 4 and 6, and 5. Divisors 2, 3, 4, 6. and 12.

2. Example. *Suppose it be required to find all the aliquot parts, and just Divisors in* 60. *I work thus.*

2) 60 (30
2) 30 (15
3) 15 (5
5) 5 (1

2, 2, 3, 5
4, 6, 10
12, 20
15
30
60

To do this, I work as before is directed, and finds 10. aliquot parts 2, 4, 3, 6, 12, 5, 10, 20, 15, 30 and 11. just Divisors 2, 4, 3, 6, 12, 5, 10, 20, 15, 30 and 60.

Note, that many other aliquot parts may be found out if Fractions were admitted, as in this Table following in the pounds.

A Table of the Aliquot parts of the moſt common Denominators uſed in *Scotland*.

Of 20. for If pounds		of 12		of 52		of 60		of 100	
S.	d.	pts.	d.	pts.	w.	pts.	m.	pts.	C.	pts.
10.	0	2	12	1	52	1	60	1	100	1
6.	8	3	6	2	26	2	30	2	50	2
5.	0	4	4	3	13	4	20	3	25	4
4.	0	5	of 16		of 30		15	4	20	5
3.	4	6	lb.	pts.	d.	pts.	12	5	10	10
2.	6	8	16	1	30	1	10	6	of 10	
2.	0	10	8	2	15	2	of 4		d.	pts.
1.	8	12	4	4	10	3	R.	pts.	10	1
1.	3	16	of 36		6	5	4	1	5	2
1.	0	20	gr.	pts.	of 24		2	2	of 6	
0.	10	24	36	1	h.	pts.	of 40		ells.	pts.
0.	8	30	18	2	24	1	F.	pts.	6	1
0.	6	40	12	3	12	2	40	1	3	2
0.	4	60	9	4	8	3	20	2	of 8	
0.	3	80	6	6	6	4	10	4	dr.	pts.
0.	2	120					8	5	8	1
0.	1	240							4	2

The uſe of the Table.

This table is divided into 5 Columns, in the firſt you have the aliquot parts, for 20. for pounds, or taking the Integers will ſerve for the aliquot parts, of degrees divided into Leagues, Guilders divided into Stuivers or any other thing divided into Scors, as firſt 20 ſh. is the 1'2 or 2. is 1'10 of a pound, degree divided into Leagues, &c.

Secondly

Secondly 5 ſh. is the 1'4. or 4 ſh. is the 1'5 of a pound &c.

In the ſecond Column you have firſt the aliquot parts of 12 for ſhillings foots, the year divided into moneths, or any other thing divided into dozens. Secondly of 16. for Stones, pounds of weight, ounces, or any other thing divided into 16. thirdly, of 36. for Drops, or any other thing divided into 36.

In the third Column you have firſt the Aliquot parts of 52. for the year divided into weeks, or any other thing divided into 52.

Secondly, of 30. for ſigns divided into degrees, moneths divided into dayes, Guilders divided into Groſs, or any other thing divided into 30. thirdly of 24. for dayes divided into hours, ſcruples divided into Grains or any other thing divided into 24.

In the fourth Column you have firſt the Aliquot parts of 60. for minuts, ſeconds, thirds and or any other thing that is divided into a Sexagenary proportion.

Secondly of 4. for Acres, Bolls, Firlets, Pecks or any other thing divided into quarters, and thirdly of 40. for falls, or any other thing divided into 40.

In the fifth Column you have firſt the aliquot parts of 100. for any thing divided into Centeſimal parts, ſecondly of 10. for any thing divided into decimal parts, thirdly of 6. for falls or any other thing divided into 6. and fourthly of 8. for any thing divided into half Quarters, as Ells Inches or the like.

The

The use of the Aliquot Parts.

WHen any Question of the Golden Rule is propounded, which hath any of the parts given, to be an Unit, you may use these Rules of practice following.

1. Rule. If the first number be an unit, you may only multiply the second number by the third (seeing the first is an Unit * which divideth not) and the product is the fourth number required.

* Ax. 12.

Example. *If* 1. *Boll of bear cost* 7 lb. *what will* 34. *Bolls cost at that Rate*?

34
7 lb.
238

To do this, I only multiply the third 34 Bolls by the second 7 lb. and the product is 238 lb. for the fourth number required.

2. Rule. If either the second or third number of the Golden Rule be an unite, then divide the other by the first, and the quotient will be the fourth Number required (seeing the other is an unite * which multiplieth not.)

* Ax. 12.

Example. *If* 12. *ounces of any thing cost* 1. lb. *what shall* 3. lb. *weight cost.*

16
3
12)48(4lb.
48
0

* 5. *Rule of Reduction.*

To do this, I first * reduce the 3 lb. weight to ounces, which makes 48. ounces, which I divide by the first 12. ounces, and the quotient is 4 lb. for the fourth number reqiured.

3. Rule. If the first number be an unite, and aliquot part of an Integer (or Fraction * taken as an Integer) divide the other by the said aliquot part, and the Quotient will be the fourth number required.

* *Def.* 20

Exam-

1. Example. *If* 1. *pound weight of any thing coſt* 5. *ſhillings, what ſhall* 12. *pound coſt at that rate*?

4) 12 (3
(0

To do this, I find the aliquot parts of 5. ſhillings to be 4. (in the Table) by which I divide the third number 12. and the quotient is 3. lb. for the fourth number required.

4. Rule. If either the ſecond or third number of the Golden Rule be an unite, and the firſt be an aliquot part of an Integer *or Fraction taken as an Integer) multiply the other thereby, and the product will be the fourth number required. *Def. 20

Example. *If* 2 *pound weight of any thing coſt* 25 lb. *what will a ſtone coſt at that rate*?

25 lb.
8
200 lb.

To do this, I multiply the ſecond number 25 lb. by the aliquot part for 2 pound, *viz.* 8. (being found in the Table, where I find in the ſecond Column the aliquot parts of 8. is 2. and of 2 is 8) the product is 200 lb. for the fourth number required.

5. Rule. If the firſt number be an unite, and the ſecond or third be parts, but not an aliquot part of an Integer (* or Fraction taken as an Integer) divide it into aliquot parts, and divide the other thereby, and add the Quotients and the ſumme will be the fourth number required. *Def. 20

Example. *If one Ell of any thing coſt* 15. *ſhilling what ſhall* 16 *Ell coſt at that rate*?

2) 16 (8 lb.
(0
3) 16 (4 lb.
(0
Summa 128

To do this, I ſeek for 15 ſh. in the Table, but finds it not, therefore I divide it into 10 ſh. and 5 ſh. and ſo find 2 for 10. ſh. and 4 for 5. ſhillings, then I divide the third 16 Ells firſt by 2. the quotient is 8 lb.

3 lb. and then by 4. the quotient is 4 lb. so is the summe of the quotients 12 lb. for the fourth number required.

6. Rule. If a Fraction or Integer taken as a Fraction be to be multiplied by an other, and that the Numerator of the one be equal to the Denominator of the other, you may cast them both away, so will the Numerator, and Denominator remaining be the product required.

Example. *Suppose* 3'4 *and* 4'5 *are to be multiplied, work this.*

3'4
4'5
3'5

To do this, I only cast away the Denominator of the first 4. and Numerator of the second 4. (seing they are equal) so will the other Numerator 3. and Denominator 5. be the product 3'5 required.

7. Rule, if a Fraction or Integer taken as a Fraction, be to be divided by an other, and that either both Numerators or both Denominators be equal, cast them both away, and the other two will be the quotient, observing to take that of the Divisor for the Numerator of the quotient, and that of the dividend for the Denominator.

1. Example. *Suppose* 4'5 *be to be divided by* 4'7. *I work thus.*

4'5
4'7
7'5

To do this, I cast away the two Numerators (seeing they are equal) and there will be 7'5 or 1, 2'5 being reduced, for the quotient required.

2. Example. *Suppose* 2'3 *be to be divided by* 1'3. *I work thus.*

To

2'3
1'3
1'2

To do this, I cast away the two Denominators (seeing they are equal) and there will be 1'2 for the quotient required.

3. Rule. If you be to multiply a Fraction by an Integer, equal to the Denominator thereof, cast away the Denominator, so will the number be the product required.

Example. *Suppose* 2'3 *be to be multiplied by* 3. *I only cast away the Denominator* 3. *and then Numerator* 2. *will be the product required.*

Table shewing the Weight of a solid Inch of any of these Mettals following in *Scotish* weight.

	ow.	dr.	gr.	ow. grts.
Gold	10	00	00	10 ' 00
Quicksilver	8	01	21	08 ' 10
Lead	6	04	17	06 ' 28
Silver	5	09	27	05 ' 61
Coper	4	14	08	04 ' 89
Hammer'd Iron	4	05	16	04 ' 34
Cast Iron	4	00	23	04 ' 04
Tin	4	00	23	04 ' 04
Marble	1	10	03	01 ' 63
Common Stone	1	01	33	01 ' 12
Honey	0	12	35	00 ' 81
Salt Waters	0	09	16	00 ' 59
Fresh Water or Wine	0	08	23	00 ' 54
Oyle	0	07	30	00 ' 49
Dry Oake	0	06	26	00 ' 42
Wheat	0	06	08	00 ' 39

A TABLE of Annualrent at 6 L. per Cent. per annum.

Pr.	Annualr.			Pr.	Annualrent.		
sh.	L.	sh.	d.	L.	L.	sh.	d.
1	0	00	01	10	00	12	00
2	0	00	01	20	01	04	00
3	0	00	02	30	01	16	00
4	0	00	03	40	02	08	00
5	0	00	03	50	03	00	00
6	0	00	04	60	03	12	00
7	0	00	05	70	04	04	00
8	0	00	06	80	04	16	00
9	0	00	06	90	05	08	00
10	0	00	07	100	06	00	00
sh.	L.	sh.	d.	L.	L.	sh.	d.
11	0	00	08	100	06	00	00
12	0	00	08	200	12	00	00
13	0	00	09	300	18	00	00
14	0	00	10	400	24	00	00
15	0	00	10	500	30	00	00
16	0	00	11	600	36	00	00
17	0	01	00	700	42	00	00
18	0	01	01	800	48	00	00
19	0	01	01	900	54	00	00
20	0	01	02	1000	60	00	00
L.	L.	sh.	d	L	L.	sh.	d.
1	0	01	02	1000	60	00	00
2	0	02	04	2000	120	00	00
3	0	03	07	3000	180	00	00
4	0	04	09	4000	240	00	00
5	0	06	00	5000	300	00	00
6	0	07	02	6000	360	00	00
7	0	08	04	7000	420	00	00
8	0	09	07	8000	480	00	00
9	0	10	09	9000	540	00	00
10	0	12	00	10000	600	00	00

The use.

TO find the Annualrent of any principal summe by this Table, if the principal summe be under 10 L. seek it under the Column of the Table and towards the right hand in the second Columne, you have the Annualrent thereof. But if the principal summe be above 10 L. seek the tens, hundreds or thousands in the third Columne, and towards the right hand in the fourth Columne you have the Annualrent belonging thereunto; and if there be any odd pounds and shillings, seek them as before, and add the Annualrent to that which you have found, and the totall is the Annualrent required.

1. Exemple.

Suppose it be required to find the Annaulrent of 138 L. 13 sh. for a year: work thus,

L.	Pr.	L.	sh.	d.	
100		6	00	00	Intereſt or Annualr.
30		1	16	00	
8		0	09	07	
13	sh.	0	00	09	
138 L.	13 sh.	8	06	04	Totall.

To find the Annualr. of any summe above 10000 L. which is not in the Table, consider that every 10000 is thereof is 600 L. Annualrent, and find the reſt as in the Table.

To find the Annualr. of any summe for one, two or three moneths, &c. take the twelve part of that, which a year yealds and that will be the Annualr. for a moneth, its double for two moneths its triple for three, &c.

A Table of Forreign Measures and Weights, compared to ours in *Scotland.*

Places Names.	Foot.	Ells.	Pound Aver.
	t. In. pts	E. In. pts	lb. ow. dr. gr.
England	1. 00'0	1. 08'0	0. 14. 12. 28
France-Paris	1. 00'8		0. 13. 12. 06
Lyon		1. 10'7	1. 00. 02. 03
Boloyn		0. 24'8	0. 13. 02. 26
The 17. Provinces			
Amsterdam	0. 11'3	0. 27'2	0. 13. 12. 06
Antwerp	0. 11'3	0' 27'2	0. 14. 08. 02
Brill	1. 01'2		
Dort	1. 02'2		
Rynland, or *Leyden*	1. 00'4	0' 27'1	0. 14. 03. 11
Lorain	0. 11'4		0. 14. 08. 02
Mechalin	0. 11'0		0. 14. 08. 02
Midleburgh	0. 11'9		0. 14. 08. 02
Strasburgh	0. 11'0		0. 13. 12. 06
Bremen	0. 11'6		0. 13. 14. 21
Cologn	0. 11'4		0. 14. 04. 05
Franckford	0. 11'4	0. 21'9	0. 13. 12. 06
Hamburgh		0. 22'8	0. 14. 00. 34
Leipsig		0. 27'1	1. 01. 05. 01
Lubeck		0. 21'8	
Noremburgh	1. 00'1	0. 27'3	0. 13. 14. 21
Bavaria	0. 11'4	Vane	
Vienna	1. 00'6	-or Rod.	0. 12. 04. 19
Spain *Castil*	1. 00'0	0. 36'0	0. 14. 10. 15
Gibralter		0. 33'1	0. 15. 03. 32
Toledo	0. 10'7	0. 32'2	0. 14. 12. 28
Portugal *Lisbon*		0. 33'0	0. 15. 11. 00
Italy *Roman* on the Monum. of *Cossutius.*	0. 11'6		1. 02. 03. 09
of *Statilius*	0. 11'7		
Roman Palms for building, whereof ten make the *Canna*	0. 08'8		
		Ell.	
Bononia	1. 02'4	0. 25'7	1. 02. 12. 27
Perch whereof 500. make a mile.	12. 90'5	3. 33'5	

Places

Places Names.	f. In. pts	E. In. pts	lb. ow. dr. gr.
Florence Brace or Ell	1. 11'0	0. 23'0	1. 02. 03. 09
Naples Palm and Brace	0. 09'6	0. 25'2	1. 05. 02. 21
Canna	6. 10'5	2. 08'5	
Genua Palm	0. 09'6		1. 04. 00. 08
Mintova	1. 06'8		1. 05. 02. 21
Millan Calamus	6. 06'5	2. 04'5	1. 04. 11. 18
Parma Cubit	1. 10'4	0' 22'4	1. 05. 02. 21
Venice	1. 01'9		1. 06. 10. 10
Other Places.			
Dantzick	0. 11'3	0' 22'8	1. 01, 09. 28
Copenhagen	0. 11'6		0. 13. 14. 21
Prague in Bohemia	1. 00'3		0. 15. 11. 00
Riga	1. 09'9		
China Cubit	1. 00'2	0. 12'2	
Turin	1. 00'7		
Cairo Cubit	1. 09'9	0. 21'9	1. 07. 13. 08
Perſian Araſh	3. 02'3	1. 01'3	
Turkiſh Pike	2. 02'4	0. 26'4	0. 12. 11. 23
Grecia	1. 00'1		
The nniverſal meaſure	3. 05'2	1. 02'2	

The uſe.

SEek the Places name in the firſt Column towards th left hand, and in the ſecond Column you have th Foots, Inches and Decimall partes of an Inch of ou meaſure contained in an foot of the place ſought and in the third column, you have the * ells, Inch and Decimall parts of an Inch of our meaſure contain ed in an ell, vare or rood of their meaſure, and in th fourth Column you have the pounds, ounces, drop and grains of our meaſure contained in a pound weigh of theirs.

* Standard ell of Edinburgh

Example. Suppoſe it be required to find the meaſurs an weight of our meaſure contained in a foot, ell or poun weight at Amſterdam. I ſeek Amſterdam in the firſt colum and in the ſecond I find 11'3. of our Inches in the Amſte dam foot; and in the third column I find 27'2 of our Inch in their ell, and in the fourth column I find their poun weight to be 13. ounces 12. drops, and 6 grains of our weigh

FINIS.

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